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Electrical World

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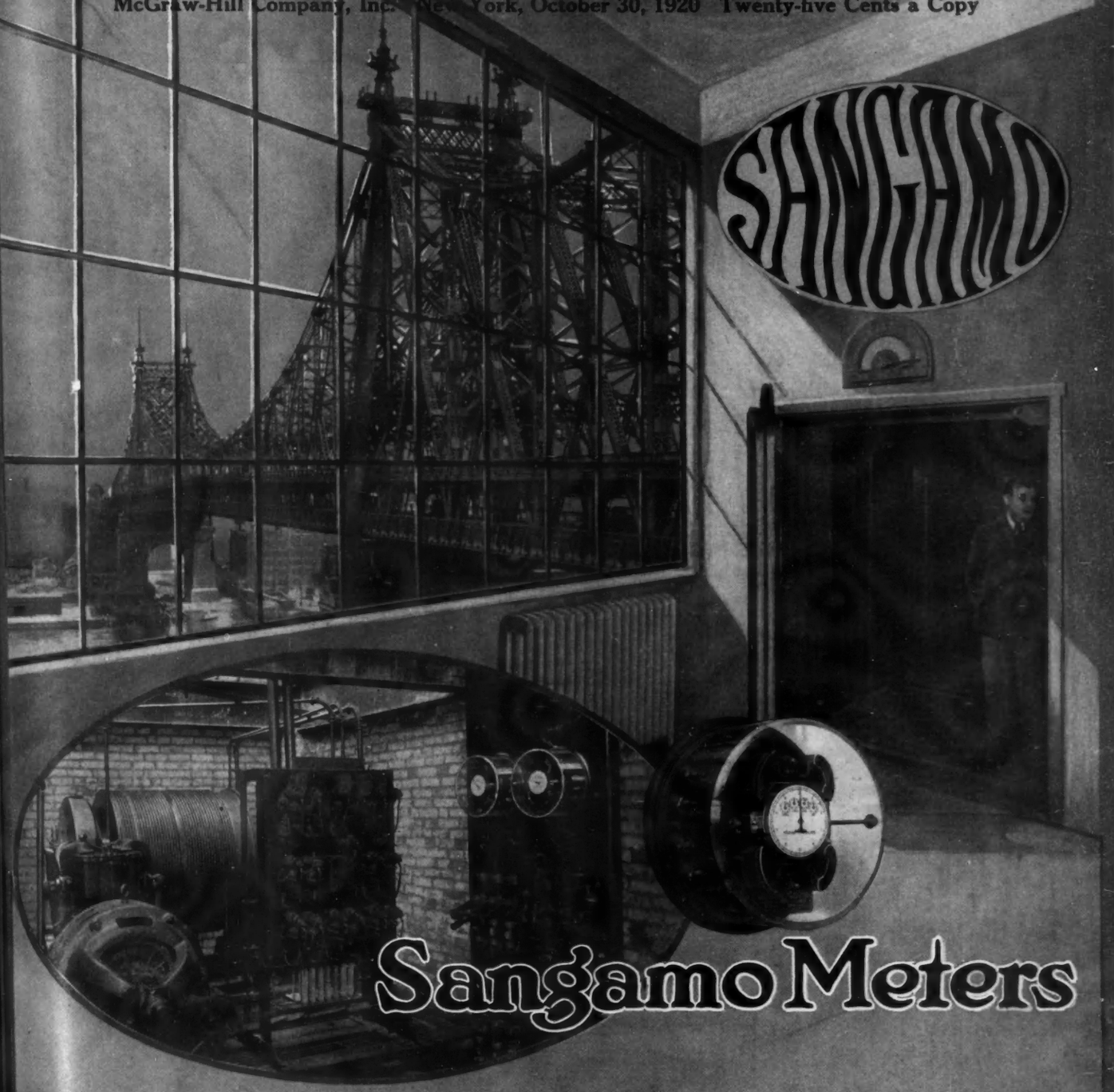

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician
Published by McGraw-Hill Company, Inc.

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Volume 76 New York, Saturday, October 30, 1920 *Number* 18

Daylight Saving and Its Drawbacks

"THANK heaven, the damn thing will soon be over!" Blunt English to be sure, and inelegant, but nevertheless the earnest ejaculation of a suburbanite who has had to arise in the pitchy darkness of a late October morning because of daylight saving. That the thought is echoed by millions of others goes without saying. Even ardent advocates of daylight saving realize the formidable opposition to it and are now willing to have the clock pushed ahead an hour on May 1 instead of April 1 and turned back again in September instead of October. As for confusion between cities that observe daylight saving and those that do not, any traveling man will voice an opinion as frank as it is profane. Indeed, public morality and business in general would gain much if daylight saving as now practiced were abolished altogether. Its merits, for daylight saving is not without merit, are manifest only when it is observed nationally. When, however, every community can have a time all its own, daylight saving becomes a farce and should be done away with.

Unnecessary Tax on Industry

COMBINING the National Electrical Code with the National Electrical Safety Code is like consolidating the fire and police departments of any city government. The best one can say of it is that it is fraught with possibilities. As every one knows, the National Electrical Code, dealing entirely with fire hazards, has been in existence some thirty years or more and has been effective in eliminating unsafe practices and in standardizing electric wiring appliances. On the other hand, the Safety Code, dealing with hazards of life and limb, has hardly been in existence long enough to give it stability. In time no doubt it will be big and strong, but even then its consolidation or incorporation with the fire code is questionable. The two codes differ so radically in character and objective that it would seem as if the best interests of the country would be conserved in keeping them absolutely free from each other. Moreover, the requirement of both characters of protection in each device, regardless of its use, is likely to place an unnecessary and unwarranted tax on industry without compensating advantages in immunity from hazards. Dual codes have been proposed locally and by some state governments, but even should they be enacted that would be no excuse for a national code which has not received the indorsement of those most vitally and directly concerned and which has not as its foundation long experience and trial in actual practice. This the Fire Underwriters' Code has and the Safety Code has not. To be successful any code must deal with realities and not with theories. The combination proposed is doubtless ideal in the abstract, but lacking nevertheless in detail. As Aristotle said of Plato, "It is beautiful, but is it practical?"

Industrial Heating Engineering

THE rapidly increasing use and future possibilities of industrial electric heating appliances make essential a thorough engineering analysis of the problems involved, together with adequate test data and operating records from installations in commercial service. Heating units adapted to liquid containers or to the heating of spaces confined to particular processes can often be well selected and applied with very little scientific analysis in emergency cases. Full and accurate quantitative data, however, are essential in order to secure the utmost service possible for the outlay required. Too often fragmentary data only are maintained by the users of concentrated electric heat, and even the industrial service departments of central stations are none too well supplied with information. Where highly developed devices suited to unique applications are used, the manufacturers are likely to possess data in fair amount, and much good should come from the dissemination of this information. The more complete it is the more rapid will be the growth of the heating load, with all its economic advantages to the user and the public utility company.

Deflation in the Electrical Industry

IN THE transition from a sellers' to a buyers' market the electrical industry needs the same type of leadership which the exigencies of the war brought out. For some time now the banks have withheld credits and insisted upon deflation in many industries. In addition, there has been a gradual slowing up of demand which nothing short of intelligent stimulation of business can bring back. It is therefore immaterial whether the goods are in the hands of the manufacturer, jobber or retailer, the important problem is to effect their distribution to the ultimate consumer and their conversion into cash. Where adequate sinking funds have been established such conversion can be made with equanimity. However, it is too much to expect that every manufacturer, jobber and dealer has been foresighted enough to provide sinking funds, notwithstanding numerous admonitions to do so; so that liquidation of stocks cannot take place without entailing some loss. Here is where intelligent leadership is required, since these losses may be kept at a minimum by a gradual and orderly price reduction which will not impair credit. This, after all, is the problem—the maintenance of

credit of the entire electrical trade. Fortunately, there has been very little profiteering in electrical goods, and money was never plentiful enough in the industry to cause over-expansion. The shock of contraction and deflation will, therefore, be slight, and if the industry will keep its wits it will hardly be felt at all.

The Facts About Railroad Electrification

THE discussion of railroad electrification at a combined meeting of the American Institute of Electrical Engineers and American Society of Mechanical Engineers in New York last week served as a reminder of battles that have been fought on the floor of the Institute over the electrification problem in the past. This problem has advanced to a new stage, however, in that it is now a question of when steam roads shall be electrified and not so much whether the direct-current or the alternating-current system is the better. The valuable test and operating data that were presented by the advocates of both steam and electric locomotives point to improved fuel economy of modern superheated and mechanically stokered steam locomotives on the one hand and justification on the other of the contention that practically two-thirds of the coal now used by steam roads could be saved by electrification. The discussion and the supporting data made it clear that railroad electrification has reached the stage where it must be solved not by engineers or railroad executives alone but on a broad economic basis. The general test which must be applied to each case is: Will the admitted advantages and economies of the electrical system pay for the added capital required to make the change?

Opportunity for Electrical Manufacturers

THERE has been evidence on every hand that American manufacturers are not taking advantage of the present opportunities for the extension of our business in foreign countries. This seems to be partly due to lack of interest in the problem of developing foreign markets. Once aroused, there is no doubt that our manufacturers have the initiative and the products to hold business and to extend it abroad. Electrical manufacturers, in particular, have an opportunity during the next year or so of doing some truly constructive work in laying a foundation for business relations with other countries by taking an active part in telling European engineers what American practice is in various branches of the electrical industry and why it is suitable as the basis of international rules.

The work of the International Electrotechnical Commission is proceeding rapidly, and the American representatives are doing all they can to show their associates from other countries what great progress has been made in the United States toward the adoption of suitable standards through such agencies as the American Institute of Electrical Engineers, the National Electric Light Association and the Electric Power Club. They need the co-operation, however, of every available agency in expounding our methods. This matter is of extreme importance to our electrical manufacturers, since they can only sell machinery or apparatus with difficulty where other standards are being adopted and put into extensive use. It may be said, however, that representatives from other nations are approaching the subject with open minds, and if they can be convinced that American standards are best they are ready to adopt them for international use.

Certainly there is at this time a ripe opportunity for an intensive educational campaign which should be backed to the utmost by our manufacturers. The president of the I. E. C. is an American who is well and favorably known abroad. During his régime, if ever, the case of the United States should be put squarely up to the international congress. It is also possible that a plenary meeting of the I. E. C. may be held in this country during Dr. Mailloux's term of office, and it should be evident to all interested that now is the time to "strike while the iron is hot."

Practical Demonstration of Industrial Lighting

PROGRESS in illumination as in everything else is a beautiful demonstration of the quantum theory. It goes by jumps which in fact are very much larger than Planck's quanta but far less frequent. Thus it is that that branch of illumination which has to do with productive industry, though it is true that it has gone ahead in the last five-and-twenty years, has not progressed oftener than once in about five years, and not always then. Except in a few lines of work which still stick to the so-called standards of twenty years ago, the introduction of gas-filled lamps and standard steel reflectors has gone a long way toward improving matters. Nevertheless, there are many cases in which the old and inefficient methods of illumination still persist—bare lamps stuck in the operator's face, ancient sputtering arcs deep hid in the gloom of the rafters, or shades, when there are any, so battered and ill adapted to their use as to be of little service. It is hard to explain courteously to a works manager that he is twenty years behind the times and harder still to persuade him that some competitor is far ahead on lighting for production.

The move now being made by the National Electric Light Association to make demonstrations on a country-wide scale for the purpose of showing how industrial lighting should be accomplished is an extremely important one, and we trust that it will be pushed to the limit. The demonstration plant built up at Nela Park under the direction of Ward Harrison and shown at the Pasadena convention and elsewhere is of unique value in scratching through the surface of even the case-hardened mind of the believer in ancient standards. It has an enormous advantage over any reference to model plants as a demonstration of the benefits of intelligently installed lighting. One cannot persuade a group of manufacturers to visit half a dozen plants in scattered territory for the purpose of seeing how much better lighting can be than that which they themselves employ. Yet in three-quarters of an hour, sitting together in the demonstrating room, the same group of men can be shown the comparative results of half a dozen methods of lighting in quick succession, and with the clearest possible showing of the differences between them, difference to which one can recur at will.

Briefly, the standard exhibit consists of a room of adequate dimensions, preferably not less than two ordinary factory bays square, lighted by all the methods, good and bad, in common use, with sufficient objects for inspection and foot-candle meters to give practical demonstration of the effect of each individual system.

The nature of the exhibition is one somewhat startling even to the experienced engineer, since he never gets the opportunity to compare so quickly and definitely one method with another. To the works manager it is a revelation, and it has been the uniform experience in the cases to which the demonstration has already been applied that the immediate result is betterment of the lighting conditions by those who absorbed the information. Such a demonstration should be of particular use in connection with the industrial lighting codes established in various states since it affords the most direct evidence of the real purpose and effect of the code provisions. The central station or the local board of trade can conduct no more useful propaganda for the betterment of industry than by staging this sort of demonstration, which can be readily adapted to show the conditions pertaining to any particular group of industries which may be locally important.

Re-establishing International Communication

THE international conference on electrical communications now being held at Washington is one of the most important that have ever taken place in this country, not merely from an electrical standpoint, but also from the viewpoint of international relations. Instructions have been received by the Washington conference from the Versailles conference to consider certain questions arising out of the war and out of the treaty of peace, such as the disposition of the German submarine cables seized by the Allies during the war and ceded by Germany in the peace settlement. Probably the conference will be followed at a comparatively early date by a still more comprehensive international conference on communications, in which many other nations will doubtless participate and at which worldwide communication regulations will probably be adopted.

The international importance of communications, and of their *modus operandi*, is so great that it can only with difficulty be exaggerated. It may be said indeed that "electrical communication" is but an alternative rendering for "peace on earth and good will toward men." When peace reigns communications grow and ramify. When nations war their communications cease. The more thoroughly we can weld and develop the interchange of world communications, the more enduringly we may hope to sustain the world's peace.

Altogether, aside from the larger aspects of international communication agreements, the importance of such agreements on the art and sicence of electromagnetic-wave generation, propagation and reception is manifestly very great. If such agreements are well drawn, they may be expected to stimulate the development of electrical knowledge, literature, invention, discovery and construction throughout the world. If, by unfortunate mischance, they are not well drawn, international progress in any or all of these directions may easily be retarded.

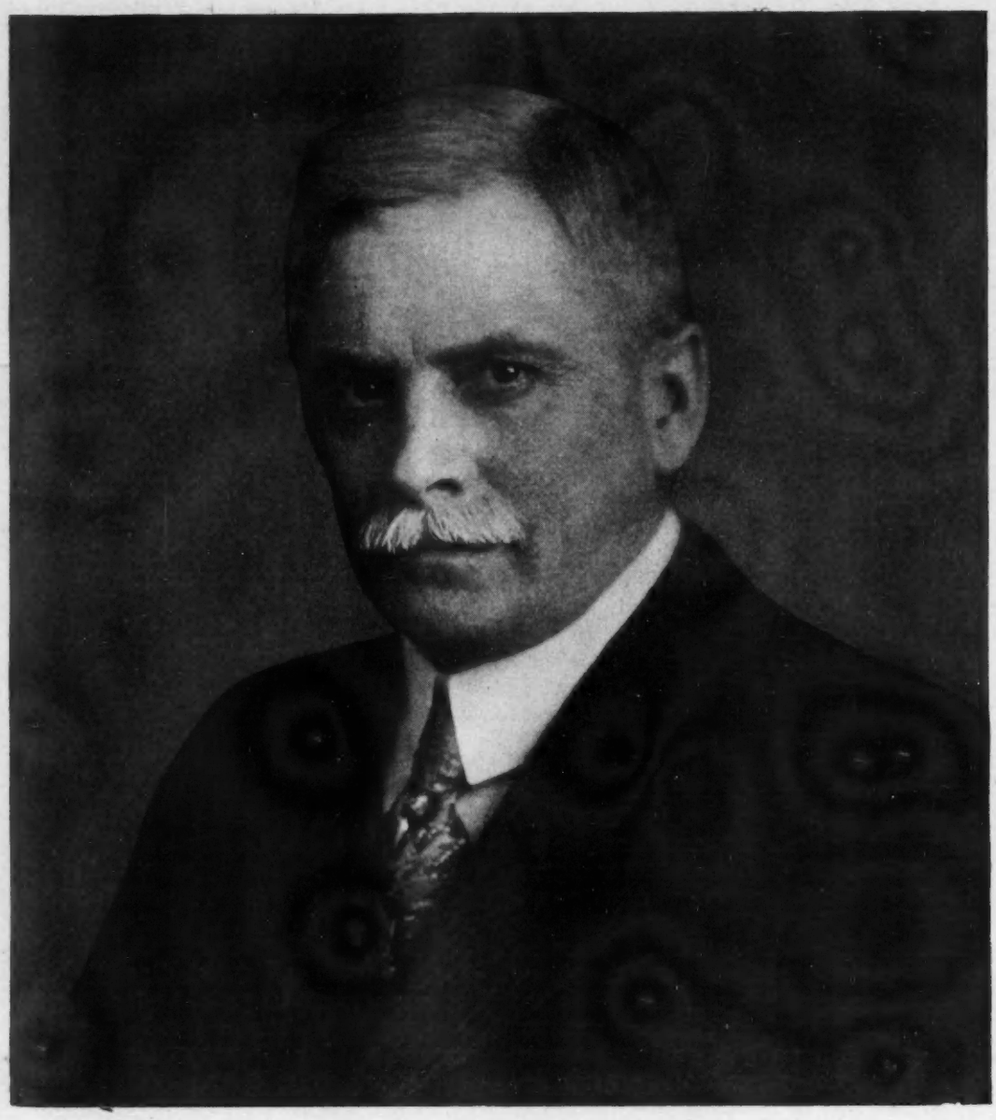
Many years ago the nations of Europe entered into a telegraphic convention at Petrograd. Ever since that time there have been international telegraph regulations regarding wire communications, but the United States was not represented at Petrograd. The advent of radio-communication and the events of the world war have powerfully affected the history of the subject. It is to be hoped that the return of peace may enable the whole subject of electrical communication to be dealt with internationally in a comprehensive way. The task is so large that it may take a long time to work out in detail. We may, however, rest assured that the final outcome will be one that the world at large will confidently indorse.

In the meantime we heartily join in the welcome extended by America to the distinguished delegates who have come to Washington from the Allied Powers in order to attend this auspicious international conference on electrical communications.

Actual Measurement of Reflection Factors

A RATHER interesting feature of the recent Illuminating Engineering Society convention was the report of new and important results in the measurement of the reflection factors of surfaces. Two papers, one by Dr. Clayton H. Sharp and W. F. Little and the other by A. H. Taylor, elucidated simple methods of employing the sphere photometer to measure directly the reflection coefficient of any surface. The two investigations hit upon almost identically the same method, leading with beautiful precision to the same results. The scheme adopted is to make the sample to be tested a small bit of the surface of a little integrating sphere and then to throw upon it a small concentrated beam of light. The entering light must thus be reflected once from the test surface and again from the sphere walls before it can reach the observation point shielded from the test surface proper by a little opaque screen. The same incident beam projected on the sphere surface somewhere else gives the standard illumination reading at the photometer, and the ratio of the two values thus measured gives the reflection coefficient of the test surface directly. The apparatus of the two investigators differed only slightly in detail and seems to be of quite the same precision and facility.

It is not in the least necessary that experiments should be made on a detached sample since a small hole in the sphere can be placed against any material *in situ* as a wall or a block of stone. Nor is it of any consequence whether the test surface is perfectly diffusing or substantially specular, the fact that this does not matter being of still more importance from the practical standpoint since the mixture of diffuse and specular reflection is a very common source of difficulty in estimating reflecting powers. The results obtained in both investigations so far as they could be compared are exactly the same, agreeing to within the reasonable limits of experimental error, and they also check with high precision investigations made by the point-to-point method. Incidentally, attention should be sharply drawn to the fact that the substance commonly taken as the standard of reflecting power, magnesium carbonate, has an actual coefficient of reflection of between 98 and 99 per cent at its topmost value instead of about 88 per cent as indicated in earlier researches. It is to be hoped that the present investigators will extend their studies to determining the standard conditions under which magnesium carbonate may be depended upon to have a closely definite value of reflectivity, so that it may be made directly useful as a comparison standard in the same sense that the cadmium cell may be used as standard of electromotive force. Certainly the simultaneous and beautifully coherent researches before us have gone far toward clearing up the whole matter of reflection factors and their easy measurement.



Bion Joseph Arnold

A pioneer in drafting service-at-cost franchises and an authority on traffic matters, yet withal an engineer of wide reputation in heavy traction installation who has devoted much attention to special engineering problems

A PRACTICAL theorist who has probably done more than any one else to solve the complicated franchise and rehabilitation problems of the electric railways—this characterizes B. J. Arnold. Although the son of a lawyer, he followed the lure of his boyhood ambition to be an engineer, for in early life his love for the mechanical stood out strong. Later, when a young man at college, he showed, especially in mechanics and science, that concentration which brings the highest honors.

He spent a few years after being graduated from Hillsdale College in 1884 in securing a general engineering experience, after which he decided to specialize in electricity and in preparation spent the college year 1888-89 at Cornell. For a short while after leaving Ithaca he was in charge of the St. Louis office of the Thomson-Houston Company, and later in 1890-93, when this company had been merged with the Edison interests into the General Electric Company, he was consulting engineer for the new organization. It was in this capacity that he did his first electric traction work which was to be of lasting importance—the design of the Intramural Railroad at the Chicago World's Fair, the forerunner of the present elevated electric railway. His success in this undertaking caused him to open an office in Chicago in 1893 and from that time his name has been inseparably linked with the progress of electric transportation.

Mr. Arnold, who has made extensive electric railway traffic studies, was a pioneer in the advocacy of service-at-cost franchises and advanced greatly the idea of the necessity for co-operation between the traction interests and the cities. He was prominent in the rehabilitation of the Chicago surface lines under the 1907 ordinance and was named therein as chairman of the board of supervising engineers to take charge of the work. He has also advised the city of New York on subway and street-railway matters, and was consulting traction engineer for Pittsburgh, Providence, Los Angeles, San Francisco, Toronto and Cincinnati. In the field of railroad electrification he is equally eminent. He was a member of the electrification commission of the New York Central appointed in 1902, electrified the St. Clair tunnel of the Grand Trunk, and was one of the early experimenters in the use of single-phase energy for transportation. One other very important phase of Mr. Arnold's engineering was pioneer work in the application of automatic substations to electric railways.

While Mr. Arnold, who is a past-president of the A. I. E. E., is affiliated with engineering societies too numerous to mention, no sketch would be complete without reference to his war record, which is symbolic of the best in American engineering tradition. Although a member of the Naval Consulting Board, he was one of the first to receive a commission under the Officers' Reserve Corps act—that of major of engineers. In December, 1917, he was transferred to the regular army, with rank of lieutenant-colonel. Here he did very valuable work in the aviation section of the Signal Corps in the development and production of aërial torpedoes.

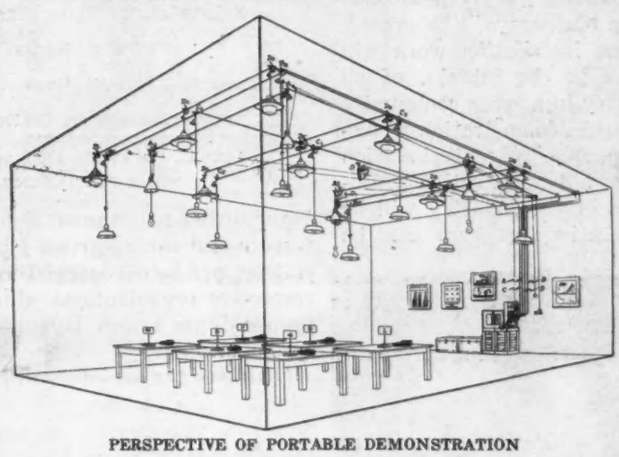
Demonstrating Effective Lighting

How Central Stations Can Convince Industrial Plant Engineers that Higher Intensity of Illumination Is a Paying Proposition — N. E. L. A. Has Started a Country-wide Campaign to Show What Good Lighting Really Is

THE past year marks a turning point in the lighting industry. The status of artificial illumination, especially in the industries, has changed from a service which has always been considered more or less an item of necessary expense to be grudgingly met into one which takes its place as a definite part of the producing and safety equipment of a plant. Old standards are passing into the discard and in their place new and higher standards are coming. There is a growing appreciation of the value of illumination on the part of the man who uses it and also a new conception on the part of the lighting industry as to the bigness of the product it has to offer.

The central station, whose business it is to sell light, is naturally responsible for the lighting education of the community, and the National Electric Light Association has embarked upon a program to show by actual demonstration in the larger cities throughout the country the new idea of adequate lighting for industrial plants. Experience so far with demonstrations of this kind has yielded remarkable results wherever they have been made. Repeated statements of the effect of light upon the safety and welfare of employees, the results of tests showing the marked effect of illumination on the earnings of industrial establishments, and the popularization of an instrument whereby illumination can be measured and compared have been important influences contributing to this new status of artificial illumination. These factors, in conjunction with a standardized illuminant—the RLM reflector and the bowl-enameled lamp, which answers the vast majority of industrial lighting requirements and therefore greatly simplifies lighting design—have resulted in a wave of enthusiasm for better light spreading over the country. This has already taken tangible form in a considerable number of lighting installations of intensities two and three times what was considered good practice several years ago. Appreciation of what good lighting will do is more pronounced than appreciation of what good lighting really is. There are a great many cases of industrial lighting where the plant manager realizes fully the importance of lighting and takes pride in an installation which he thinks is good, but which may in reality be far from good. To the vast majority of individuals, including lighting men who in installing lighting systems have thought of them in terms of outlets, sockets, switches, etc., illumination as a final product at the working plane is a new thought. Experience has shown that the printed story or even verbal statement of the story is inadequate to carry the message of what good lighting is and what it will do. During the past year the industry has been shown on a big scale what actual demonstration of lighting results can accomplish in this respect. An elaborate demonstration of industrial lighting at the Pasadena convention of the National Electric Light Association brought forcibly to the minds of those in attendance the importance of different aspects of illumination design and gave a new conception of the kind of lighting which is being recommended today—a kind of lighting which must be seen and felt to be appreciated. This demonstration, originally used at Nela Park by the National Lamp Works under the direction of Ward Harrison and since installed in a number of cities throughout the country, has not only been instrumental in convincing industrial managers who have seen it of the advantages to be gained from modern illumination but has also

PORTABLE LIGHTING DEMONSTRATION EQUIPMENT BEING USED WHERE A PERMANENT ARRANGEMENT IS NOT FEASIBLE



PERSPECTIVE OF PORTABLE DEMONSTRATION

DATA ON EQUIPMENT

System	No. Units	Lamp	Reflector	Spacing	Height
A*	4	200-w. clear	Deep bowl	15 ft. x 15 ft.	10 ft. 6 in.
B†	4	200-w. b.e.	R.L.M. dome	20 ft. x 20 ft.	10 ft. 6 in.
C‡	5	200-w. b.e.	R.L.M. dome	10 ft. x 10 ft.	10 ft. 6 in.
I.¶	9	500-w. C-2	Glass-inclosed	10 ft. x 10 ft.	14 ft.
S§	1	200-w. frosted	Projecting	.....	14 ft.

* Reflectors on cords. † Units on cords to raise to 14 ft. ‡ Supplements B system. ¶ One piece diffusing and reflecting unit. § Directed on platform apparatus and connected through a rheostat to vary the illumination.

been the means of imparting to the electric industry itself enthusiasm for the marketing of a standard of illumination so different from what has prevailed in the past as to constitute virtually a new product.

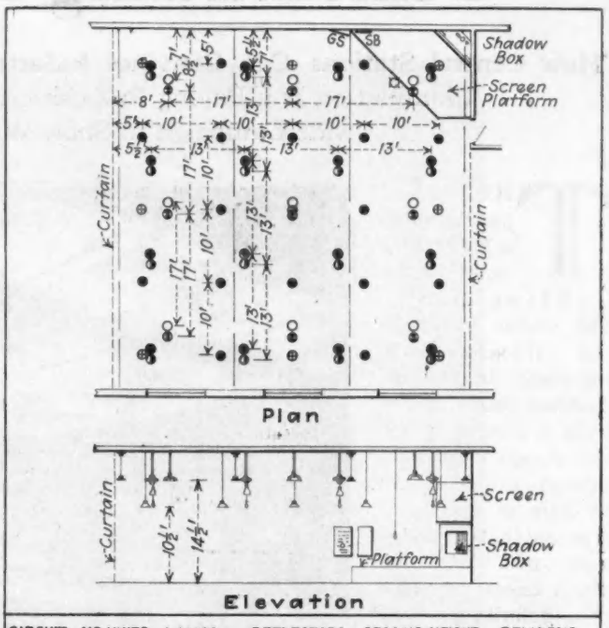
So important does the National Electric Light Association consider demonstrations as a means of advancing the cause of better lighting that it has inaugurated a lighting department controlled by a committee, of which Clarence Law is chairman. This committee has instituted a program to make available permanent demonstration installations in all the larger cities. The services of Ward Harrison, well known for his work in lighting circles, have been loaned by the lamp companies to act as field director to co-operate with the central stations installing the demonstration equipment. It is believed the demonstration method is so effective in bringing about a proper understanding of lighting that every city of considerable size should have a permanently equipped room in which different types of lighting systems, ranging from bad to good, can be shown. In smaller cities it may not always be practicable to have a permanent demonstration, and in these cases central stations are encouraged to obtain portable demonstration equipment to be used in better lighting campaigns.

How the Industry Benefits by Lighting Demonstrations

All interests connected with the lighting industry will find a common advantage in this better lighting program. As a result of advancing the standards of illumination the central-station business will be greatly increased and considerable new installation work will be called for. It is therefore to the interest of all branches of the electrical industry in a given community to co-operate in making the local demonstration a success. In a given locality, for example, the central station may father the establishment of a demonstration installation to which other branches of the industry will be invited and a general co-operative program can be inaugurated to improve lighting conditions. The contractor and the electrical jobber, as well as the central station, will be encouraged to delegate some one in their respective organizations who will be qualified to make proper illumination layouts—in short, be a lighting specialist.

DEMONSTRATING MODERN LIGHTING AT BALTIMORE

This photograph was taken by the actual light of the demonstration equipment—about 75 foot-candles on the tables. The room is the cafeteria of the Consolidated Gas, Electric Light & Power Company, and it may be observed that the wiring is completely concealed. The guests are the National Electrical Contractors and Dealers' Association delegates at the recent Baltimore meeting.



CIRCUIT	NO. UNITS	LAMPS	REFLECTORS	SPACING	HEIGHT	REMARKS
◑	16	100-W. cl.	Deep Bowl	13'x13'	10½'	Reflectors on Strings
⊕	9	200-W.B.E.	RLM Dome	20'x20'	10½'	
●	16	200-W.B.E.	RLM Dome	10'x10'	10½'	Supplements Circuit ⊕
⊕	9	200-W.B.E.	Glass Top Dome	17'x17'	14½'	
○	9	500-W.B.E.	RLM Dome	17'x17'	14½'	
◉	16	500-W.C-2	Glass encl.	13'x13'	14½'	Daylight Lamps in one-piece diffusing and reflecting Units
□	1	300-W. cl.	None	As Shown	7'	On String. To show glare
GS	1	500-W. AF	None	As Shown		Behind glare Sign
SB	Switchboard for Control of all Circuits					

ACTUAL LOCATION AND ARRANGEMENT OF LAMPS FOR A PERMANENT DEMONSTRATION

Owing to the variation in local conditions, it is impossible to submit a design for a demonstration room which would be universal in its application. For this reason the National Electric Light Association is prepared to furnish assistance in making a design suitable in each case for the best space that is found to be available. The accompanying illustrations show demonstration equipments for both the permanent and portable type which have been used with great success.

The following example illustrates what can be done in a community where the central station accepts its responsibility for leadership in promoting the new standard of illumination. A certain central-station manager, who had previously considered the industrial lighting field in his little city pretty well developed, chanced to attend a "modern lighting" demonstration. He was absolutely convinced of the possibilities in this direction and immediately arranged for a number of factory managers and superintendents in his city to attend a similar demonstration. They were all responsive and eager to learn, and they gladly consented to make the trip at their own expense to a nearby city to attend the demonstration. To quote a number of men, "We learned more about illumination in one day than we had learned in a lifetime." Seeing is believing.

One plant manager immediately analyzed his own lighting conditions. He was in the process of having a new lighting system put in at the time, and it was already pretty far along. It consisted of 100-watt clear lamps in glass reflectors and would have provided about 1½ foot-candles. He had this system taken out completely and accepted the recommendations from the central station for a complete modern system giving about 14 foot-candles, and he has since acknowledged his complete satisfaction with the change. Others who at this time made no alterations in their lighting systems instituted regular maintenance schedules and repainted the interiors in good light-reflecting colors.

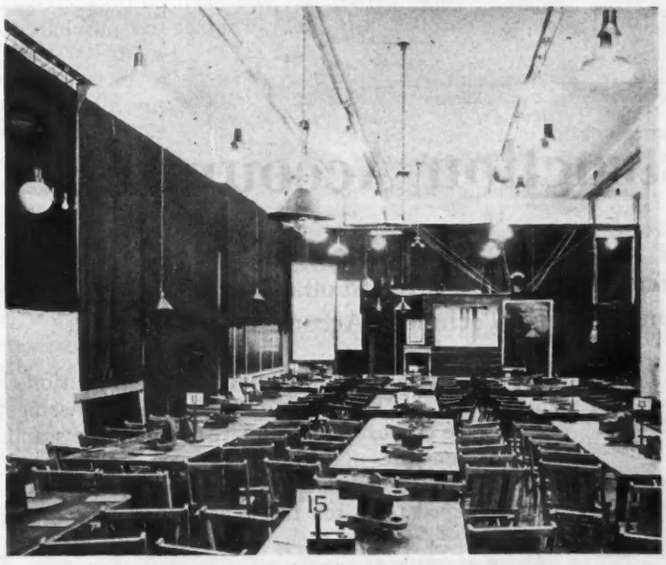
The central-station manager reports as shown in the accompanying table.*

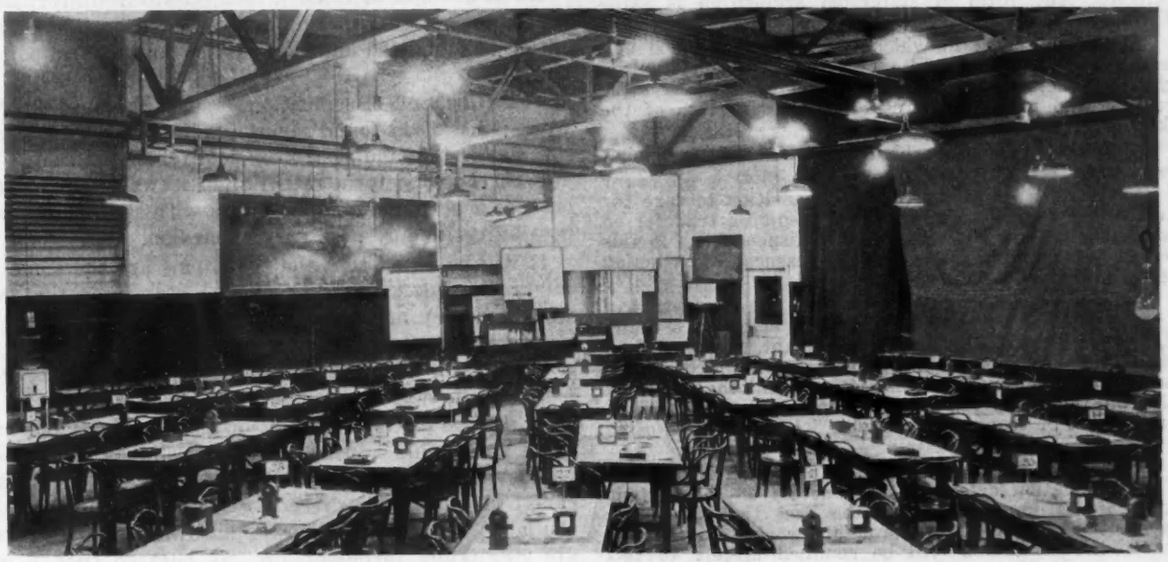
As already mentioned, where it is impracticable to arrange for a permanent demonstration a portable demonstration outfit may be obtained and used with good results. A perspective drawing shows the equipment and wiring used in one of these portable outfits. The apparatus is compactly arranged, with all wiring, switches and equipment ready to install at any location where a suitable room is available.

This demonstration apparatus has been installed in a number of cities, and although its capacity is some-

*Paper presented at I. E. S. convention, Cleveland, Oct. 4-7, 1920.

January to July, 1919, by old, costly method of trial installation:	
Added lighting load	68.5 kw.
Added revenue, per year	$10,800
January to July, 1920, direct method of one day at a lighting demonstration:	
Added lighting load	431 kw.
Added revenue, per year	$62,934
First seven months of 1919, fixtures sold, 39; total price	$535.72
First seven months of 1920, fixtures sold, 1,038; total price	$6,016.00





TYPICAL ARRANGEMENTS THAT ARE BEING USED TO DEMONSTRATE THE NEW STANDARDS OF ILLUMINATION

Top, at left, how a demonstration was worked out at the Pasadena convention of the N. E. L. A. Note the easiness for observing effects of various lighting combinations. Top, at right, permanent room at Harrison, N. J. This room has been used with good effect in connection with factory inspectors of New Jersey and other large groups. At bottom, permanent demonstration room at Nela Park, out of which has developed the present movement for good lighting.

what limited, it has been used effectively for previously organized educational campaigns for better lighting. As an example, the demonstration recently conducted in Columbus, Ohio, might be cited.

In this case the electric interests of the city decided to stage a big educational campaign for better lighting. The demonstration was made under the auspices of the Columbus Electrical Contractors and Dealers' Association, the industrial department of the Y. M. C. A., the department of electrical engineering of Ohio State University, the Manufacturers and Jobbers' Association, the Chamber of Commerce and the Ohio Industrial Commission during the week of Sept. 20. Each day was given over to a certain class of persons, such as electrical contractors, engineers and architects, manufacturers, retailers and finally the general public. Invitations to attend the demonstration were sent out to each group within a radius of 50 miles as well as within the city, and in this way a good attendance was secured. The whole program, which carried the slogan "Better Lighting Week," is an example of what can and ought to be done in all of the industrial centers of the country. As a result of the backing which the project attracted it is safe to predict an added impetus toward better lighting in Columbus and the surrounding district.

A display in demonstration of good lighting has been installed by the Edison Lamp Works at Harrison, N. J., and used effectively for instructional courses given to all of the district office salesmen. The factory inspectors of the Department of Labor in New Jersey have also been shown the possibilities of good illumination at this demonstration, a photograph of which is shown.

The demonstration method of promoting better lighting is a means of bringing all branches of the industry together on a common ground and selling a single product, which is illumination of the proper quality and quantity at the work. It provides a display of this ultimate product in comparison with inferior products and not only enables those in the electrical industry to judge this finished product but also educates the consumer in the matter of purchasing illumination and being in a position to judge what he has purchased.

Applying Construction Accounting

A Material and Labor Classification Keyed to General Property Accounts Necessary—Field Forces Should Not Be Brought Into Contact with Technical Accounting

A CONSTRUCTION accounting system conforming with the principles outlined in the previous article* must contain the following principal factors:

1. A form for reporting labor performed. This may be either the ordinary form of time book or the time slip, though the time slip is preferable.

2. A method of reporting material issued from the storeroom. Any form of storeroom acquisition is satisfactory.

3. A weekly report in which the labor performed and material used is summarized. This is for the information of the construction department in checking costs and the executives who may be interested in the progress of the work.

4. A special form on which material and equipment removed from service must be reported.

5. A variation of the storeroom requisition to care for the materials returned to stores for credit or transferred to other jobs is desirable though not indispensable. It aids materially in checking a form of carelessness construction forces are peculiarly afflicted with.

6. A form on which a final report of the completion of the job, including an inventory of the material actually used, must be submitted. This is important, as it is a final check on the accuracy of the other material records and gives the construction accounting department the means of eliminating the big errors of failure to report unused material for credit or transfer to another job that are so often met.

7. A construction classification. The formation of this and its application determine the success of the system. Because of its importance and the fact that the other items mentioned are pretty thoroughly worked out in general use the discussion will be confined largely to this subject.

8. Any construction force will find it necessary to make emergency purchases of material and use a petty cash fund. Methods of handling these are so well known that no discussion here is needed.

*Sept. 18, 1920, issue of ELECTRICAL WORLD.

In the formation of a construction classification three things must be kept in mind: (a) The classification must not be overextended, and (b) it must be standardized; a new classification for every job cannot be tolerated, as it produces endless confusion; (c) it must be keyed to match the general property classification.

As an example of construction classification formation the following transmission and distribution line classification is submitted and the reasons for its form pointed out.

This form of classification is used because in field work it has been found much less liable to error than a decimal system and easier for field forces to grasp.

A three-group form rather than a two-group is used, because it permits standardization with almost unlimited possibility for any necessary expansion.

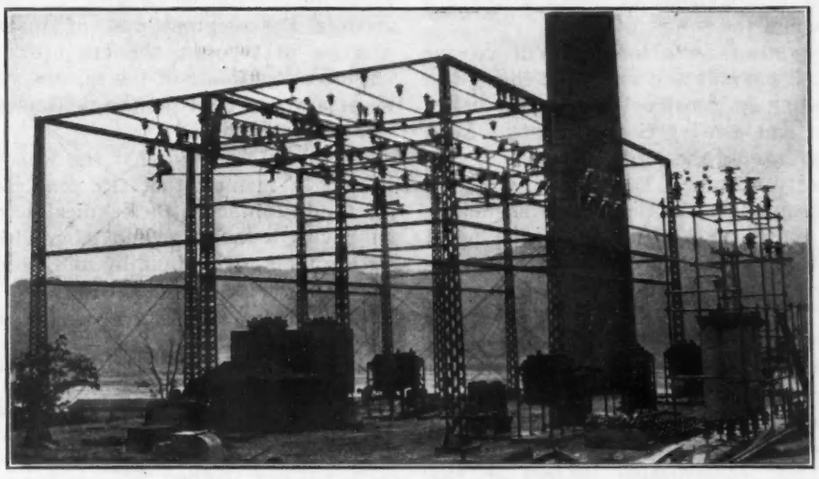
It will be noted that the cost items are the same for all groups, viz.: (a), (c) or (d) stand for the same wherever they appear. In the second group it will be noted that the capital letter is followed in all cases by a numeral in order to maintain the form and prevent confusion between the capital and small letters.

In the use of the classification the erection labor on a wood pole would appear on a time slip as 61—A1—d, while a steel tower item would be 61—A2—d. A significant fact is the note preceding the pole group in which the labor items on cross-arms, hardware and insulators are specifically forbidden for use because such a procedure means an impractical attempt at subdivision. This is an important fact to keep in mind in formulating a classification. Keep groupings to the main items and do not attempt minute subdivisions.

In the classification of which this is a part an entire

state property account classification was covered without repetition of construction classification groups. This was accomplished by segregating the construction classification into general and specific groups. The general groups cover real estate, rights of way, construction equipment, overhead groups and all items that might apply to any one of the specific groups. The specific groups covered those things that were peculiar to power plants, transmission or distribution lines, etc., and confusion was avoided by assigning job numbers so that a single job did not cover more than one property division, such as a steam-electric plant, a transmission line or a hydro-electric plant. The proper sheets for any job should be selected from the classification. The numbering of the overhead groups in the illustration indicates how this was accomplished. Certain groups of numbers were assigned to each general classification group, and while the numbers run to over 600 the actual numbers used to cover the entire state classification totaled thirty-six, the remainder being left open for future expansion, though very little of the room left can be used except to insert entire new groups.

The entire classification is also cross-referenced with the state property account groups, so that with a job complete and corrected in the construction accounting department the transfer to the general property accounts becomes merely a clerical job. The organization for handling the work should consist of a field force, who are merely timekeepers and material men handling payrolls and original vouchers, and an office construction accounting force, who are responsible for the construction ledgers and preparing the cost records for transfer to the general property accounts, which should be handled by the general accounting department. The general accounting department should also keep a set of control accounts by job numbers, against which the construction ledgers must be balanced monthly, thus making the construction records an integral part of the entire accounting record.



A PROPER COST ACCOUNTING SYSTEM IS REQUIRED IN CONNECTION WITH SUBSTATIONS AS MUCH AS WITH LARGER JOBS

With such a system worked out accurate accounts are available for checking or appraisal purposes.

Overhead Transmission and Distribution Lines

61. Poles, Towers and Fixtures

NOTE: In using this group please note that under no circumstances shall labor charges be made to Groups A4 and A8 inclusive. All labor charges for these groups except those for handling and hauling to the point of use shall be made to (f) framing under A1, A2 or A3, depending on the class of poles or towers being used.

A—POLES, TOWERS AND FIXTURES
- 1—Wood poles.
- 2—Steel towers.
- 3—Wood towers.
- 4—Wood crossarms.
- 5—Steel crossarms.
- 6—Hardware.
- 7—Pin-type insulators and pins.
- 8—Suspension insulators and fittings.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor of erection.
  - (e) Digging holes.
  - (f) Framing.
  - (p) Painting.
  - (w) Wrecking.

B1—GUYS
- (a) Cost of materials and freight.
- (c) Handling and hauling.
- (d) Labor of erection.
- (e) Digging holes.
- (w) Wrecking.

C—POLE-TOP SWITCHES
(Used for line sectionalizing only)
- 1—Pole-top switches.
- 2—Supporting framework.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

62. Overhead Conductors.

A—CONDUCTORS AND GROUND WIRE
- 1—Conductors and tie wire.
- 2—Ground wire.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

63. Overhead Telephone System

NOTE: All labor of placing A1 crossarms and A2 insulators and pins in position shall be charged to 61 A1, A2 or A3, depending on the class of poles or towers being used.

A—TELEPHONE EQUIPMENT
- 1—Crossarms.
- 2—Insulators and pins.
- 3—Conductors.
- 4—Instruments and protective devices.
- 5—Booths.
- 6—Other equipment.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

64. Customers' Equipment

A—CUSTOMERS' TRANSFORMERS AND INSTALLATION
- 1—Transformers.
- 2—Material.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

B1—CUSTOMER'S SERVICES
- 1 (a) Cost of materials and freight.
- (c) Handling and hauling.
- (d) Labor.
- (w) Wrecking.

C—CUSTOMERS' METERS
- 1—Meters.
- 2—Materials and erection.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

65. Municipal Lighting System
- 1—Wire.
- 1—Incandescent lamp supports and fixtures.
- 3—Arc.
- 4—Arc lamps.
- 5—Incandescent lamps.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

66. Reconstruction of Foreign Properties

A—ACCOUNTS OF PHYSICAL INTERFERENCE
- 1—Telephone Lines.
- 2—Other properties.

B—ACCOUNT OF ELECTRICAL INTERFERENCES
- 1—Inductive interference.
- 2—Other interference.

OVERHEAD

601. Engineering

A1—ENGINEERING

B—SUPERINTENDENCE AND TIMEKEEPING
- 1—Superintendent's salary and expenses.
- 2—Timekeepers, checkers, etc., salaries.
- 3—Inspectors' salaries.
- 4—Construction accounting.
- 5—Miscellaneous supplies and expenses.

602. General Expenses

A1—General officers' salaries.
- 2—General office clerical salaries.

B—EXPENSES
- 1—General officers' salaries.
- 2—General office clerical salaries.

C—SUPPLIES AND EXPENSES DURING CONSTRUCTION
- 1—General office supplies and expenses.
- 2—General office stationary and printing.

603. Legal Expenses and Damages

A—LEGAL EXPENSES
- 1—Attorneys' fees.
- 2—Traveling and living expenses.
- 3—Recording and notary fees.
- 4—Miscellaneous expenses.

B—INJURIES AND DAMAGES
- 1—Damage claims paid.
- 2—Court costs and fees.

604. Insurance, Taxes and Interest
- A—1. Insurance during construction.
- B—1. Taxes during construction.
- C—1. Interest during construction.

605. Other Expenditures During Construction
- A—1. Storeroom expenses.
- B—1. Purchasing department.
- C—1. New business expenses.

629. Contingencies (estimating only)

630. Total

The routine from construction force to general property records will work out about as follows:

Field Force.—Will handle and distribute to the construction classification all time slips and other vouchers. All charges will carry the designation "Ncn" or "Rcn." Make up all payrolls for payment of men. Prepare a physical inventory when the job is complete.

Construction Accounting Department.—Will receive from the field force all payrolls and vouchers, check field distributions and enter in construction ledgers under proper job numbers and construction accounts. Each construction account should be cross-indexed to the proper general property account. To secure the payroll distributions and check them the field force should be required to furnish copies of the time slips with detail distribution, which will be summarized by the construction accounting office. When a job is complete a summary of the costs will be drawn from the record, checked against a summarization of the weekly reports, errors corrected and vouchers prepared for transfer to general property accounts.

General Accounting Department.—Will maintain control accounts for the construction ledgers and enter the transfer vouchers from construction ledgers in the general ledger.

In this routine a discussion of payment of bills, handling of petty cash accounts and the other items that must complete the system from an accounting standpoint hardly needs mention, as they are well understood.

One final item that is not touched is the writing off of equipment removed from service. The construction force reports the physical property taken out. The construction accounting department should secure from the records the original cost of installation, or, in the absence of records, the engineer's estimate, and the engineer's estimate of the salvage value. From this the necessary vouchers for the retirement of the equipment can be prepared.

It will be observed that the whole routine is laid out in such a manner that the construction forces do not come into contact with technical accounting. They deal only with a material and labor classification which is within their understanding and which can be kept with little knowledge of accounting.

The construction accounting department deals with the technical problems and is the tie between the construction and general accounting departments.

The objection that the forces required to carry out such a routine are excessive will be raised. As a matter of fact they will be no larger than those required to carry out any method that secures accurate records and will be little larger than those required to carry out similar work in many places where results are not secured. Proper study will simplify the routine and cut the work to the minimum.

Basic Theory of Electron-Tube Amplifiers—II

Various Arrangements of the Tubes Are Analyzed to Show What Conditions Are Necessary for Maximum Amplification—Historical Development of the Three-Electrode Tube Is Discussed

By MARIUS LATOUR
Consulting Engineer, Paris, France

THE development of the three-electrode tube was treated historically in the first part of this article, published in the ELECTRICAL WORLD for Sept. 11, 1920, and equations were set up indicating the most favorable proportions for various circuit constants. In this concluding portion of the paper two methods of amplification are dealt with, namely:

(1) Operation of a single tube near the critical condition at which oscillations start.

(2) Use of a number of tubes for successive amplification, resulting in a "multistage" amplifier.

It is pointed out that in either case great care must be taken not to carry the amplifying effect to such extremes that violent, uncontrollable oscillations will be set up. The important fact is also brought out that it is possible to amplify not only watt power but reactive power as well.

All the circuit arrangements included in the first method correspond necessarily to those used for generation of free oscillations.[1]

Fig. 9, in which the transformers T_1 and T_2 are connected in series through the source S and capacity C, represents one such arrangement.

The expressions for current I in resistance R, of current j in the grid circuit and of current J in the plate circuit are derived with particular ease, if one regards the tube simply as a generator of internal voltage $Kr_g j$ and internal resistance R_p. The grid current j can be said to exert an irreversible action on the plate circuit causing the appearance in that circuit of the internal voltage $Kr_g j$.

Let us take for the origin of phases that of the voltage $e \sin \omega t$ of the source S, and let I_1, j_1, J_1, be the current components in phase with $e \sin \omega t$ and I_2, j_2, J_2—the components in quadrature.

Let L, L_g, L_p be the self-induction coefficients of the circuits: resistance R, grid and plate; and finally, let M_g and M_p be the mutual induction coefficients of the transformers T_1 and T_2. The following equations express these important relations:

[1] These circuit arrangements were described by Meissner (*Telefunken*) in 1913 and 1914. Gutton also gave some interesting special forms. In my patent No. 491,186 (May, 1915) I have very explicitly described the principle of operation of three-electrode amplifiers near the critical point at which oscillations start. This type of amplifier having been indirectly described in Meissner patent No. 467,747, the originality of my patent exists only for arrangements not derivable from Meissner's and also for arrangements utilizing two-electrode vacuum tubes.

$$RI_1 + \left(L - \frac{1}{C\omega^2}\right)\omega I_2 - M_g\omega j_2 + M_p\omega J_2 = e$$

$$-\left(\lambda - \frac{1}{C\omega^2}\right) I_1 + RI_2 + M_g\omega j_1 - M_p\omega J_1 = 0$$

$$r_g j_1 + L_g\omega j_2 - M_g\omega I_2 = 0$$

$$-L_g\omega j_1 + r_g j_2 + M_g\omega I_1 = 0$$

$$-R_p J_1 - L_p\omega J_2 M_p\omega I_2 K r_g j_1 = 0$$

$$L_p\omega J_1 - R_p J_2 - M_p\omega I_1 + K r_g j_2 = 0$$

All circuit arrangements comprising a three-electrode tube which are capable of generating oscillations lead to a system of equations of the above kind, since there are always at least three circuits (the output circuit, the grid circuit and the plate circuit). The treatment can be simplified by neglecting the power in the grid-filament circuit and consequently the direct inductive effect of the grid circuit on the output circuit R. In any case the solution of the system of equations involves nothing more than the work of calculation. The following conclusions are arrived at:

(1) For a certain relation between the constants L, C, L_g, L_p, M_g, M_p, the component I_1 becomes zero (the reactance of the system is nul).

(2) For a certain relation between the same constants compatible with the one required by (1) I becomes infinite; in other words, the relay effect becomes infinite. The apparent resistance of the output circuit becomes zero.

When this apparent resistance becomes negative spontaneous oscillations are of course generated, as has been pointed out at the beginning of this article. From a physical point of view the theoretically obtainable unlimited amplification can be given the following interpretation:

Let us first imagine that the voltage e of the source S is the only one impressed and disregard the reaction of the grid voltage on the plate circuit and all its consequences. The voltage e creates a current I in the R circuit (the induced currents through resistances R_p and r_g being of course taken into account). The flow of current I will in its turn result in a certain voltage drop u between the grid and the filament.

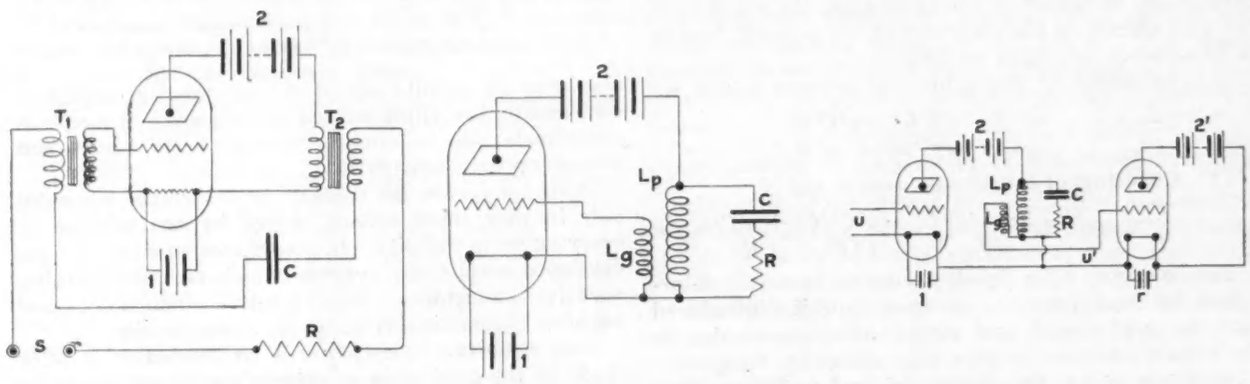
Let us now consider this voltage u by itself and assume the voltage e of source S suppressed. The voltage u will establish a voltage ku in the plate circuit and as a consequence a current I' through the source S in the circuit comprising resistance R.

Let us first assume that the constants of the circuit are such that I' is in phase with I. It is seen immediately that I' allows us to reconstitute I. For instance, let I' return us a fraction $\frac{m}{n}$ of I. The source S will have to supply only the reduced voltage $\frac{n-m}{n}e$ in order that the corresponding current $\frac{n-m}{n}I$ added to I' shall reconstitute the total current I.

In other words, without amplification a voltage e from source S was needed to force a current I through resistance R; with amplification, the smaller voltage $\frac{n-m}{n}e$ is sufficient. This amounts to saying that for the same voltage e the current I is multiplied by the factor $\frac{n-m}{n}$, which becomes infinite for $n = m$.

I have assumed that I' was in phase with I. For the general case, I' not in phase with I, the exact formulation is as follows:

The effective current I in the circuit R is the geometric sum of the two currents: (1) Current I' produced by voltage ku, which is related to the circulation of current I. (2) Current I'' due to voltage e considered as acting alone.



FIGS. 9, 10 AND 11 —VARIOUS ARRANGEMENTS FOR THE PURPOSE OF PRODUCING HIGH AMPLIFICATION

To have at our disposal the current I, it is thus necessary to give the voltage e a value that would supply only I''—the geometric difference between I and I'. The amplification is I/I'', provided $I'' < I$. The infinite amplification discussed above is, of course, purely theoretical, because too close an approach to the critical conditions involves the danger of uncontrollably violent oscillations.

The amplification can, however, be made the greater, at equal stability, the more powerful the tube; *i.e.*, the stronger the thermionic emission.

Connections such as shown in Fig. 9 have in general the disadvantage that the amount of amplification varies with the frequency. The reason for this is that the current I' differs in phase from current I more or less according to frequency. To reproduce current I it is therefore necessary to change not only the magnitude of e but also its phase. Nevertheless, it is possible to devise connections which give a constant amplification over an extended interval of frequencies.

Having been led to the discussion of the generation of oscillations by means of three-electrode tubes, a few words may be added to explain its very simple mechanism: The connections most frequently used for the

generation of oscillations are represented by Fig. 10. Let L_p and L_g be the self-induction coefficients of the plate and grid circuit respectively and M their mutual-induction coefficient.

Let us imagine that we have two identical tubes (Fig. 11) and that the grid inductance is not placed in the grid-filament circuit of the tube connected to the oscillating circuit, but is made to act on the grid-filament of the second tube. A voltage u is applied between the grid and the filament of the first tube; this causes a voltage u' to appear immediately between the grid and the filament of the second tube. The possibility of self-excitation—*i.e.*, of generation of oscillations by means of the first tube alone—obviously depends on such a choice of constants that $u' = u$ (in phase and magnitude). This reasoning is perfectly analogous to that adopted in the treatment of self-excitation of electrical machines. I adopted this mode of treatment in an article which appeared in the London *Electrician* of Dec. 1, 1916. The required mathematical conditions are derived from examination of the circuits.

Under the assumption that the power consumed in the grid circuit (the exciting circuit) is small, it is permissible to neglect in the calculation the reaction of the grid circuit on the plate circuit. The conditions of self-excitation are then as follows:

(1) Condition of phase identity between n and n':

$$\frac{L_g\omega}{r_g} = -\frac{R_p}{L_p\omega}\,\frac{1-\omega^2CL_p+\omega^2C^2R^2}{1-\omega^2C^2R^2+\omega CR}.$$

(2) Condition of equality between n and n':

$$M = -\frac{L_p}{K} - R_p\,\frac{R_p(1-\omega^4C^2L_p^2+\omega^2C^2R^2)+\omega^4C^2L_p^2R}{\omega^2L_p(1-\omega^2C^2R^2+\omega CR)}.$$

The frequency $\omega/2\pi$ in self-excitation is mainly determined by condition (1). A small capacity introduced into the grid circuit and giving a negative value to the circuit reactance considerably affects the frequency.

M being given, the region of self-excitation with regard to current is such as to give k an average value satisfying condition (2). The average k diminishes as the current increases. When the power taken by the excitation (the grid circuit) is considerable, the reaction of the grid circuit upon the oscillation circuit can no longer be neglected. It can be shown that this reaction causes a supplementary damping which retards the self-excitation and may even prevent it entirely. An excessive increase of M may therefore make self-excitation in some cases impossible.

AMPLIFICATION BY USING SEVERAL TUBES IN CASCADE

In the second method for increasing amplification recourse is taken to the use of a number of tubes in cascade (see Fig. 12, where three tubes are shown). This arrangement requires no additional explanations. The intermediary transformers T' can be calculated by applying the same reasoning as before. Their ratio is $r_1' = \sqrt{r_g/R_p}$.

In the first method an amplification limit was imposed by the danger of uncontrollable oscillations. This is equally true of the cascade method. Even when the greatest precautions are taken to avoid inter-reactions between the plate and grid circuit of each tube, a point is always reached when sufficient coupling between the input and output circuits is established to limit the practically obtainable amplification; in spite of all precautions free oscillations of uncontrollable magnitude finally make their appearance. These oscillations often have a frequency out of all proportion with the capacities and inductances used and give rise in the telephone to periodic noises rather than musical tones.

It is important to emphasize the important fact—one that does not seem to have been brought to light as yet—that an amplifying system in accordance with Fig. 12 can amplify not only watt-power but also magnetizing or reactive power.

In such a system, if one admits any inter-reaction between the entering and the outgoing circuit, it is no more true in theory that leading current cannot be produced without the intervention of a capacity (as is true in any system of ordinary circuits[2]) so that Boucherot's principle of conservation of reactive power is no longer valid. Self-excitation thus becomes conceivable even in circuits devoid of the capacity needed to compensate the effect of the inductances; it becomes conceivable also in circuits devoid of inductance and possessing only capacity.

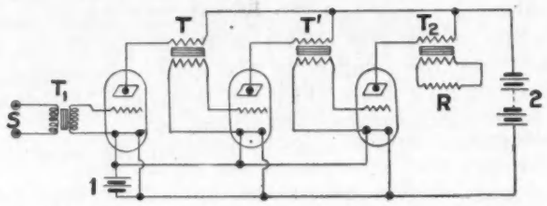


FIG. 12.—AMPLIFICATION BY SEVERAL TUBES IN CASCADE

In such a system the capacity or inductance is needed only in very small amount solely for the purpose of assuring some stability. In accordance with this I have developed amplifying systems which permit obtaining negative inductance from positive inductance and negative capacitance from positive capacitance.

This important question will be treated in a later study of the conditions of generation of oscillations in multistage amplifiers. It can be shown that even the smallest capacity in the grid circuit exerts a great influence on the frequency of the oscillations, which increases with the resistance of the grid-filament circuit.

YOU *have just the kind of an organization necessary to protect and advance your interests, and the time was never more propitious in which to reason with the public about your rights. The demonstrated folly of the past neglect of the railroads has left the public mind open for a fair consideration of the rights of other utilities. The only thing to consider is whether you are fully alive to your own needs and are asserting them with the vigor and earnestness requisite. Your annual convention is, of course, an ideal and effective time at which to exchange views and experiences, to the end that each of you may benefit by the other's knowledge. You cannot, however, get results through well-sounding resolutions, in convention assembled, but only through constant well-planned efforts 365 days a year. In short, it is entirely up to you men just how effective you make your organization. But if you are to profit by the very dear experience of the railroads, you will work together and thoroughly acquaint the public with your needs.*—J. A. C. KENNEDY, General Counsel of Nebraska Power Company, before Nebraska Section, N. E. L. A.

[2]See the author's article in the *Lumiere Electrique* of April, 1907, p. 5, "On Some General Theorems Relating to Electrical Engineering."

Power Needs on the Pacific Coast

Extent of Power Shortage in California—Feasible Sites and Prospective Developments in Washington and Oregon—Future Opportunities Seen for Electrochemical and Electrometallurgical Loads

By F. H. FOWLER
District Engineer U. S. Forest Service, San Francisco

THE utilization of our water powers has become a vital question. The estimate of the potential water powers of the United States prepared by the Geological Survey for the National Conservation Commission in 1908, published by the Commissioner of Corporations in his report on "Water Power Developed in the United States, 1912," and later revised and republished in Senate Document 316, Sixty-fourth Congress, first session, is still the most authoritative estimate of potential power for the entire country. Funds should have been provided long since for a detailed study, covering the United States, in the manner that is now proposed for the North Atlantic States.

The accompanying condensed tabulation from Senate Document 316, compiled on a basis of 70 per cent efficiency, will bring to mind the regional distribution of our potential water-power resources:

POTENTIAL WATER POWER OF THE UNITED STATES

	Minimum		Maximum	
	Horsepower	Per Cent	Horsepower	Per Cent
New England	868,000	3.11	1,605,000	2.98
Middle Atlantic	1,357,000	4.86	2,488,000	4.62
East North-Central	832,000	2.98	1,604,000	2.98
West North-Central	902,000	3.23	1,956,000	3.63
South Atlantic	2,346,000	8.39	4,257,000	7.90
East South-Central	1,087,000	3.89	1,964,000	3.64
West South-Central	353,000	1.26	822,000	1.52
Mountain	8,694,000	31.11	16,131,000	29.92
Pacific	11,504,000	41.17	23,078,000	42.81
United States	27,943,000	100.00	53,905,000	100.00
Segregation of potential power in Pacific States:				
Washington	4,932,000	17.65	8,647,000	16.04
Oregon	3,148,000	11.27	6,613,000	12.27
California	3,424,000	12.25	7,818,000	14.50
	11,504,000	41.17	23,078,000	42.81

In no section of the United States does topography so greatly influence not only climate and power resources but also the distribution of population and industries as in Washington, Oregon and California. The great Cordilleran mountain system extending along the west coast of both Americas, and locally known as the Sierra Nevada Mountains in California and as the Cascade Range in Oregon and Washington, not only protects the western coastal strip in these states from the more rigorous climate of the interior but also presents a barrier against which drift the storms and moisture-laden winds of the Pacific.

In California the distance from the ocean to the main crest of the Sierras is about 175 miles (280 km.), in Oregon the average distance from the ocean to the crest of the Cascades is about 120 miles (190 km.), while in Washington the distance from the ocean proper to the crest of the main ridges is about the same but the distance from the eastern shore of Puget Sound to the crest is not more than 50 to 60 miles (80 km. to 96 km.). The storms drifting from the ocean landward are deflected upward and cooled, first by the Coast Range, which robs them of a portion of their moisture, and then by the main Cordillera, on the slopes of which they drop most of their watery load. Records show a more or less uniform increase of precipitation with elevation on the western slopes of the Sierras to a certain elevation, which in California appears to be about 7,000 ft. (2,100 m.), east of which there is a gradual decrease in mean annual precipitation to the crest of the ridge and then a very rapid decrease.

Mean annual precipitation at different points in the Pacific States varies between the widest limits found in the country. At certain points on the coast of Washington and Oregon the mean annual rainfall runs as high as 133 in. (338 cm.), but as one proceeds southward along the coast there is a continuous decrease until in the vicinity of San Diego the mean annual rainfall is but 9.56 in. (24 cm.). The lowest mean seasonal precipitation in the region is found in the desert country of southeastern California, where at times no rain has fallen for several years in succession. The mean recorded at one of the stations in this area is but 2.34 in. (5.8 cm.) as compared with 133 in. on the northwest coast.

Loads Carried by California Water-Power Stations

California hydro-electric systems are now operating water-power plants with a combined capacity of about 543,000 kva. and steam auxiliaries with an additional capacity of 285,000 kva., a grand total of 828,000 kva., or 1,110,000 hp. The combined installation in hydro-electric plants of Washington and Oregon is about two-thirds that in California.

The average load carried by most of the hydro-electric plants is under 60 per cent of their rated capacity, and an annual increase of 35,000 kva. in mean load would therefore necessitate an annual installation of at least 60,000 kva. in hydro-electric generating machinery after the present deficiencies are made up. In short, California should have a total installed hydro capacity of 800,000 kva. by 1921 and an annual increase of 60,000 kva. each year thereafter to handle adequately the normal increase in load. If large electrochemical, electrometallurgical or railway loads are developed, the rate of increase will be proportionally greater.

Detailed figures for the growth of load in Washington and Oregon are not now available but are being collected by the National Electric Light Association. Unless new power uses are developed within the two states, the growth in lead will hardly be as rapid proportionally as in California.

The estimates given in the table serve merely as a basis for regional comparisons of potential power. Far more detailed studies have been completed on certain drainages by the federal and state governments, municipalities and engineering and public utility companies. Most of the Puget Sound streams and those in southern Washington have been studied in detail by the United States Geological Survey in co-operation with the State of Washington. Results already published show a total of 232,000 hp. without storage and 391,000 hp. with storage for the Cowlitz, Nisqually, Puyallup, White,

Green and Cedar Rivers, draining the territory between Portland and Seattle, north of the Columbia and east of Puget Sound. Similar studies show an average minimum of 389,500 hp. (since found to be somewhat higher) for the Klickitat, White Salmon, Little White Salmon, Lewis and Toutle Rivers, draining into the Columbia from the north, between the mouth of the Cowlitz and The Dalles. The Yakima, which drains the basin east of the Columbia, will produce only 12,000 hp. continuously, but 105,000 hp. may be developed during the irrigation season. Natches River, principal tributary of the Yakima, will yield 57,530 hp. continuously without, and 97,950 hp. with, storage, while its mean for the irrigation season, with storage, is 160,500 hp. Clealum River, another tributary of the Yakima, will yield 4,770 hp. without, and 21,560 hp. with, storage.

POWER POSSIBILITIES AT THE DALLES

Developments at Priest, Kettle and Rock Island Rapids and The Dalles, on the main Columbia, have been proposed from time to time, but investigations of power possibilities at The Dalles appear to have been carried farther than for the other sites. A detailed report of power available at The Dalles was prepared by co-operation between the state and federal governments, in 1913.*

The project contemplated the development of power at Five-Mile Rapids near the Dalles, 90 miles (144 km.) east of Portland and 187 miles (300 km.) above the mouth of the river. The minimum recorded flow at this point was 41,900 sec.-ft. (1,170 cu.m. per second) and the maximum 1,170,000 sec.-ft. (32,700 cu.m.). At an average low-water discharge of 50,000 sec.-ft. (1,400 cu.m.) the estimated net head was 105 ft. (3.15 m.), and at a high-water discharge of 800,000 sec.-ft. (16,800 cu.m.) it was 45 ft. (14.5 m.). It was estimated that 480,000 hp. could be developed continuously, and that there would be 120,000 hp. more available for eleven months, an additional 100,000 hp. for ten months, and still another 100,000 hp. for eight months, giving a total development of 800,000 hp. that might be considered economically justifiable by stream-flow conditions.

It was estimated that the cost would be $104 per horsepower for a development of 480,000 hp., $62.50 per horsepower for 800,000 hp., or $46.30 per horsepower on the basis of the total rated capacity of generators (1,080,000 hp.) that would have to be installed in order to obtain the continuous output of 800,000 hp. The plant would operate at its full capacity during only four months of the average year.

The State Engineer of Oregon has made tentative studies of other large projections on the Columbia, Snake, Deschutes, Rogue and Klamath, capable of continuous output of 2,401,000 electric horsepower.

A tabulation of proposed developments in California prepared by the writer in October, 1919, showed a combined proposed installation of 2,100,000 kva. Many well known possibilities were not included. It appears, therefore, that the state's potential supply is ample for years to come.

THE ELECTROCHEMICAL OUTLOOK

That the very large water powers of the Pacific Coast will eventually be utilized as a source of energy for electrochemical and electrometallurgical industries none can doubt, but the date of their utilization is highly uncertain. Were unit cost of construction the only possible deterrent, many large developments would be under way today. Availability of raw materials and the market for the finished products are the most serious handicaps.

The results of investigations carried out in connection with the Columbia power project are unfortunately general in their application. In connection with that project industry after industry was investigated as a possible outlet for large blocks of power, only to be abandoned as probably unprofitable under prospective market conditions. That the site is one of the most wonderful in the country cannot be denied, but its development is for the future and not the present.

The earliest development of extensive electrochemical and electrometallurgical industries on the Pacific Coast will probably be on Puget Sound, where there is ample water power susceptible of development at relatively low unit cost, in moderate-sized units, and in such close proximity to tidewater as to minimize transmission costs and losses. The Columbia River and lower Willamette near Portland, offering similar advantages but in a less conspicuous degree, may be expected to follow in turn.

LONG DISTANCE TRANSMISSION A HANDICAP TO CALIFORNIA ELECTROCHEMICAL DEVELOPMENT

The writer does not anticipate that California will ever compete with her northern neighbors on a large scale in electrochemical manufacturing for export, especially in those branches of the industry where power cost is a large percentage of the total cost. Its manufacturing for the local market will probably far exceed that in the other two states. Natural conditions in California lead to high unit costs in hydro-electric installations, especially where long trunk transmission lines are included. In order to get the most favorable power rate it would therefore be necessary to establish the electrochemical industry near the generating station, which may be from 90 to 175 miles (145 km. to 280 km.) from tidewater, with consequent higher freight charges and shipping difficulties. If, on the other hand, these transportation difficulties are avoided by establishing the industry on tidewater, the cost of power will be considerably greater. Market alone will determine whether a given industry can flourish despite these conditions which affect the final selling price of the product.

Probably the lowest power rate yet quoted in California is $2.50 per kilowatt per month for twenty-four-hour power based on the maximum average demand for a fifteen-minute period. This rate was established for the encouragement of electrochemical and electrometallurgical industries other than remelting. It is granted at the option of the power company or upon order of the California Railroad Commission. The base rate is subject to an additional charge of 6 cents per kilowatt maximum demand for each 1 per cent that the average power factor falls below 90 per cent. A general surcharge since allowed by the Railroad Commission to take care of increase in all generating costs permits an additional charge of 0.2 cents per kilowatt-hour. The net cost per horsepower-year, therefore, ranges from $35.45 for 90 per cent power factor and 100 per cent load factor down to $32.84 with 90 per cent power factor but only 80 per cent load factor.

*"The Columbia Power Project," Bulletin No. 3, accompanying Fourth Biennial Report of State Engineer John H. Lewis, Jan. 11, 1913, by L. F. Harza, project engineer.

600,000-Hp. Line Delivers Niagara Power*

Six Circuits Spaced for 88,000 Volts Are Supported on Cantilevers Overhanging Hydraulic Canal—Special Precautions Taken to Guard Against Failure

By J. ALLEN JOHNSON
Electrical Engineer Niagara Falls Power Company

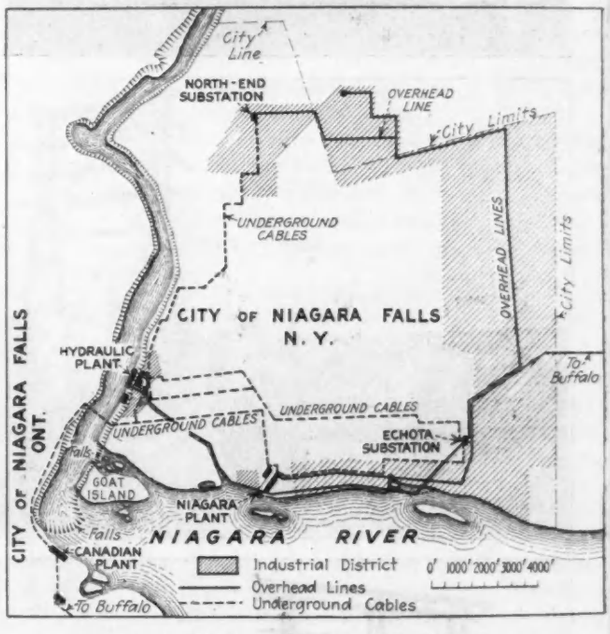
THE problem of transmitting the 100,000 hp. generated in the Niagara Falls extension was complicated by many factors. In the first place the prospective load for this development was concentrated within a comparatively narrow area adjacent to the upper river, so that it was necessary that the entire output should be transmitted in a single direction. The city has few available streets leading in the desired direction, and most of these were already occupied by conduit systems.

As a second consideration, the character of the load, which has a daily load factor of over 95 per cent (the power being mostly used for electrochemical and electrometallurgical purposes), is the worst possible for underground transmission because the constant generation of heat in the cables causes a considerable reduction in their transmitting capacity compared with that on a system of low load factor.

As a third consideration, a glance into the future indicated the probability of a much larger transmission of Niagara power to Buffalo in the not distant future, requiring a much higher voltage than that used for local distribution. In this event the proper location for the step-up transformers would be close to the generating station. A 3-mile (4.2-km.) underground transmission to Echota, the center of load, at generator voltage before stepping up would be economically unsound. Furthermore it appeared very probable that additional development of power at this point would be required in order to meet the double demand for more power on the one hand and increased economy in use of water on the other. Overhead transmission would permit the necessary high voltage for long-distance transmission and would also provide the necessary flexibility to care for future increases in power development, either by adding more circuits or by raising the transmission voltage. In addition to all other considerations, cost estimates showed a differential in favor of overhead transmission of about one to three, which under the existing conditions of high costs was an extremely important consideration. Fortunately, the company already possessed in its canal right-of-way through the city a possible outlet for overhead lines if a way could be found to utilize it without interfering with its use as a waterway. As finally constructed the transmission line has a length of 16,000 ft. (4,800 m.) and runs from the terminal building up the canal to the river, thence following the bank past the plant of the old Niagara Falls Power Company (now known as the Niagara plant) and finally turning away from the river again at Echota to connect with the Echota substation.

The solution of the transmission problem was greatly facilitated by the consolidation of the two power companies inasmuch as land for the location of the line for the greater part of its length was already in possession of one or the other of them. For a distance of approximately 4,000 ft. (1,200 m.) through the heart of the city, however, it was necessary to make use of the property already occupied by the hydraulic canal. The accompanying halftone illustrations show clearly how this was accomplished by means of steel cantilevers anchored into massive concrete foundations on one bank of the canal, upon which were erected the six-circuit transmission towers.

For the greater part of the distance it was only found necessary for the narrow bases of the towers to be placed over the canal right-of-way, easement being obtained from abutting property owners for the overhanging portion of the construction. At the large



ROUTES FOLLOWED BY PRINCIPAL TIE LINES AND FEEDERS OF NIAGARA FALLS SYSTEM

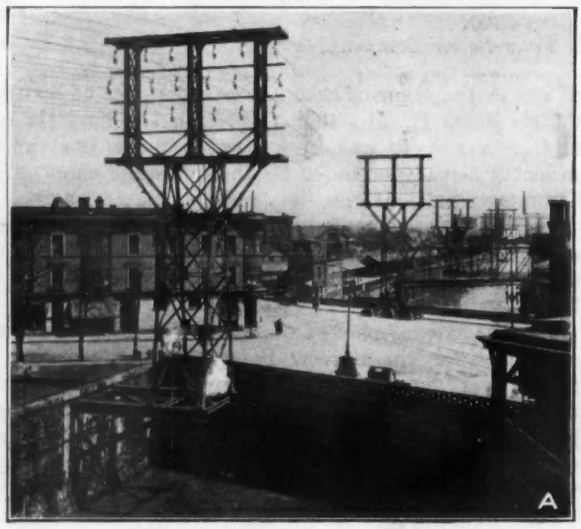
bridge spanning the canal at the junction of Third and Niagara Streets, however, this was not possible, and it was necessary to place two towers entirely over the canal. This was accomplished by means of cantilevers extra heavily braced.

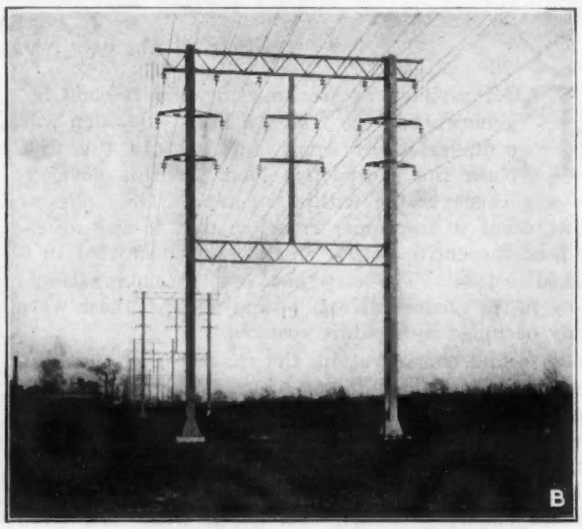
The main horizontal members of this structure are composed of two 30-in. (75-cm.) I beams, each 60 ft. (18 m.) long, placed side by side. Thirty feet (9 m.) of these beams is buried in the massive concrete foundation, the other 30 ft. projecting out over the canal. In these structures the center line of the towers is 25 ft. (7.5 m.) from the face of the canal wall. A heavy brace was added to these special structures to give stability and rigidity, although not needed for strength. In the case of the short cantilevers the brace was omitted.

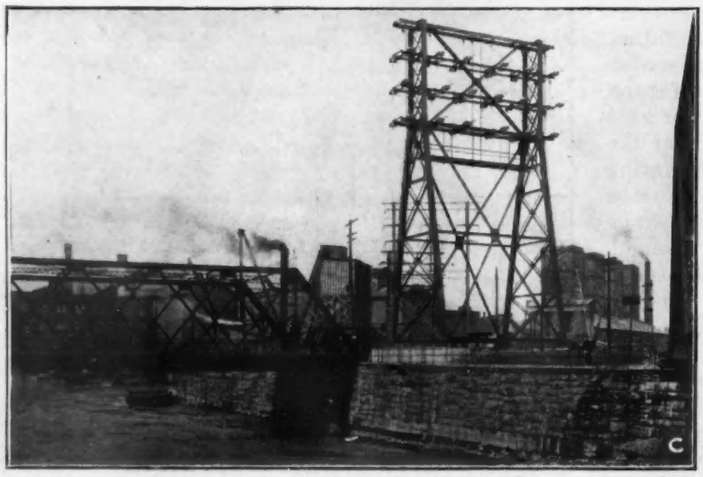
In addition to the special narrow-base towers used on

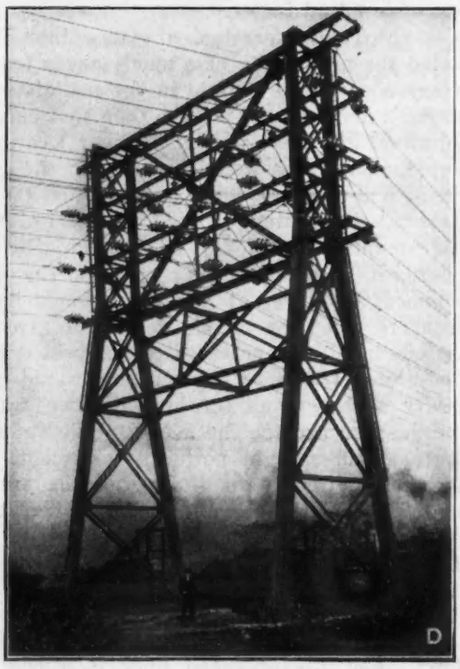
*Fifth installment of a symposium on the 100,000-hp. extension to station No. 3 of the Niagara Falls Power Company. (See Sept. 18, Oct. 2, Oct. 16 and Oct. 23 issues of the ELECTRICAL WORLD.

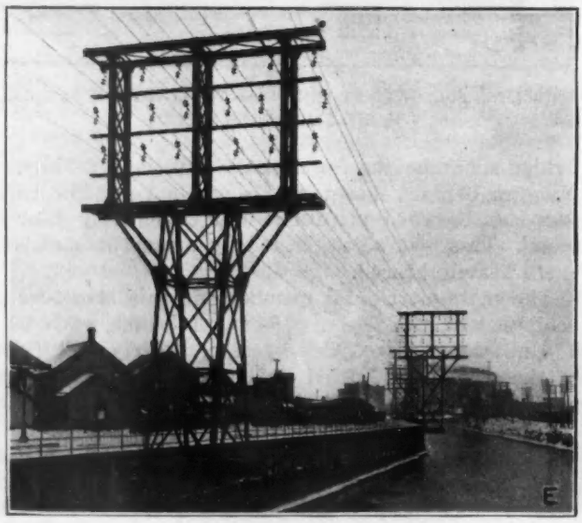
Tower Construction Used to Support Six Circuits from Niagara Falls 100,000-Hp. Extension to Echota Substation

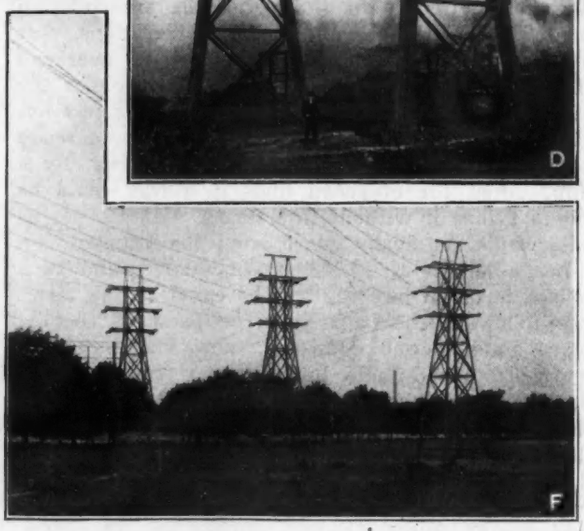












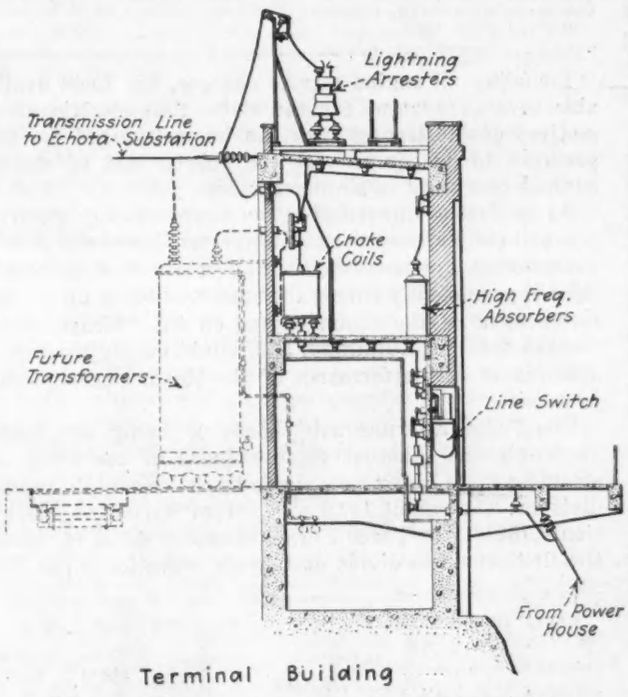
A—Tower on cantilever support for extreme overhang.
B—Straightaway towers supporting six circuits.
C—Angle tower at road crossing.
D—Portal tower over main roadway.

E—Cantilever bracing was omitted where overhang was not excessive
F—Sharp turn accomplished by using three double-circuit towers.

the canal section, the local conditions called for the use of several other types of structure. In full-strain positions three different types were employed, the standard-strain type, portal strain, and two-circuit strain. Between strain points the line is supported on flexible steel bents of portal construction.

The portal type of construction was used for the section along the river bank where the line is built over a future street. For a distance of approximately 1,000 ft. (300 m.) the land which this street is to occupy has not yet been filled in, and the towers were erected on heavy concrete abutments constructed in the bed of the river. One of the towers so placed was a full-strain angle tower.

At the substation end of the line three two-circuit strain towers were used in order to provide for the proper distribution of the circuits at the substation



CROSS-SECTION OF TERMINAL BUILDING FROM WHICH LINES RUN TO ECHOTA

wall. As may be observed the line comprises six three-phase circuits, each consisting of 500,000-circ.mil stranded medium-hard-drawn copper. At present two circuits are used for each 32,500-kva. unit at 12,000 volts, but clearances are provided for 88,000 volts. At 44,000 volts each circuit will have a nominal capacity of one unit of 32,500 kva., and at 88,000 volts each circuit will, if necessary, easily handle the output of three such units, or 97,500 kva. At 88,000 volts, therefore, the capacity of the six circuits will be 585,000 kva., or, roughly, 600,000 hp. It is believed that this is by far the largest capacity for which a transmission line was ever constructed.

Owing to the fact that this line passes through the business portion of a busy city, special precautions were taken to guard against failure. Although the ultimate strength of each conductor is over 20,000 lb. (9,000 kg.), they are strung for a maximum tension under worst conditions of wind and ice of only 6,000 lb. (2,700 kg.). At strain towers double-strain insulators are used having a strength approximately equal to that of the conductor. Short spans, not exceeding 350 ft. (105 m.), were used as a further contribution toward safety and stability.

The line is insulated with Jeffrey-Dewitt suspension-type insulators, two units being used in suspension strings and three in strain. Each of the insulator units was tested electrically to flash over at not less than 90,000 volts and also to a mechanical tension of 8,000 lb. (3,600 kg.). On the canal section, because of the peculiarities of the right-of-way, it was impossible to avoid a number of small angles, at which points suspension strings with hold-downs were used.

Insulator clamps, strain yokes and other miscellaneous insulator hardware were furnished by the Locke Insulator Manufacturing Company.

The line is protected against lightning by five overhead ground wires. On about half the line, where no corrosive fumes from chemical plants were to be expected, ⅜-in. (9.6-mm.) galvanized Siemens-Martin steel-strand was used. For the second half, where the line passes in close proximity to the chemical plants, ⅜-in. copper-clad wire was used for this purpose.

At the terminals of the line, at the terminal building and the Echota substation, the lines are first dead-ended on steel towers at some distance from the building and then looped to eye bolts embedded in the building construction, which is especially reinforced to withstand the tension of the conductors.

The proposal to mount the heavy towers on cantilevers along the bank of the canal came from R. L. Allen of the Archbold-Brady Company of Syracuse, to whom also is due the excellent and pleasing design of the towers. The company named furnished the towers for the entire line.

Testing of Government Supplies

FOR many years, as recounted in an address made before the Washington Academy of Sciences by Edward B. Rosa, chief physicist of the United States Bureau of Standards, electric lamps purchased by the Government have been systematically inspected at the factory and samples selected for life test in the laboratory. The information so obtained is utilized in the preparation and periodical revision of standard specifications which are used in the purchase and testing of lamps. Formerly lamps were bought by each department or government establishment separately, without specifications or tests. The prices were relatively high and the quality of the lamps was often uncertain or poor. Since adopting the new method prices have been lowest and the quality the best afforded.

The ordering of lamps by each department is now a simple routine operation, whereas formerly the separate purchasing of lamps involved dealing with agents of various manufacturers and guessing as to who offered the best values. The systematic testing of lamps by the government not only protects the government in its purchases, but it protects the public in large measure, for the test tends to keep up the quality of the entire product and so benefits the public. The value of this work, which puts the purchase of lamps by the government on a business basis and protects the manufacturer of a high-grade product as well as the user, is many times the cost of the work. The influence of the government, instead of being hurtful as it formerly was, is thus stimulating and helpful to the industry, tending to raise the quality of the product and to improve business methods.

Data on Electric Locomotive Performance

The Advantages Upon Which the Case of Electrification Rests Are Mainly Economy of Fuel, Increased Haulage, Low Maintenance and General Flexibility of Electric Locomotives

A COMPARISON of the modern steam and electric locomotive leads immediately to a discussion of the relative fitness of the two types of motive power to meet service conditions, according to A. H. Armstrong, chairman electrification committee of the General Electric Company. In a paper read before the joint meeting of A. S. M. E. and A. I. E. E. sections at New York City on Oct. 22, he gave important data on the performance records of electric locomotives which is abstracted in the following paragraphs.

Accepting the Mikado and Mallet as the highest developments of steam-road and helper engines for freight service, the general comparison of Table I

TABLE I—COMPARISON OF STEAM AND ELECTRIC LOCOMOTIVES

	Mikado	Mallet	Electric
Type	2-8-2	2-8-8-2	6-8-8-6
Weight per driving axle, lb.	60,000	60,000	60,000
Number of driving axles	4	8	12
Total weight on drivers, lb.	240,000	480,000	720,000
Total weight locomotive and tender, lb.	480,000	800,000	780,000
Traction effort at 18 per cent coefficient	43,200	86,400	129,600
Gross tons, 2 per cent grade	940	1,880	2,820
Trailing tons, 2 per cent grade	693	1,495	2,430
Speed on 2 per cent grade, m.p.h.	14	9	16
Horsepower at driver rims	1,620	2,080	5,570
Indicated horsepower at 80 per cent efficiency	2,030	2,600	.....
Trailing ton-miles per hour on 2 per cent gradient	9,700	13,500	38,800

is drawn with an entirely practicable electric locomotive that can be built without in any respect going beyond the experience embodied in locomotives now operating successfully.

This analysis brings out the fact that to equal the hourly ton-mile performance of one electric locomotive it would require three and four engine crews respectively for the Mallet and Mikado types.

The electric locomotive has demonstrated its very great advantages in relieving congestion on single-track mountain-grade divisions. Due to the increase in number of meeting points through its higher speed, and on account of the independence of climatic conditions of the electric locomotive and other time-saving factors, it is safe to say that the daily tonnage capacity of single-track mountain-grade divisions will be increased fully 50 per cent over possible steam-engine performance by the adoption of the electric locomotive.

The hazard of mountain operation is greatest on down grades, and it is left to electricity to effect the safe

TABLE II—ELECTRIC LOCOMOTIVE MAINTENANCE DATA FOR 1919

	N. Y. C.	C., M. & St. P.	B., A. & P.
Number of locomotives owned	73	45	28
Locomotive weight, tons	118	290	84
Annual mileage	1,946,879	2,321,148	566,977
Cost of repairs per mile, cents	6.39	14.65	6.48

control of descending trains by supplying regenerative electric braking.

The electric locomotive shows great advantage over the steam engine in cost of maintenance. Special importance attaches to this item of expense in these days of high labor and material costs. Electric locomotives are now being operated 3,000 miles (4 800 km.) between inspections on at least two electrified railways and the data that are given in Table II show recent costs. In contrast, it can be stated that the present cost of maintaining a type 2-8-8-2 Mallet may be taken at 60 cents per engine-mile, without including many miscellaneous charges not shared by the electric locomotive. Possibly more direct comparison may be better drawn by expressing maintenance in terms of driver weight, as in Table III.

TABLE III—STEAM AND ELECTRIC REPAIRS ON WEIGHT BASIS

	Steam Mallet	C., M. & St. P. Elec.
Cost of repairs per mile, cents	60	14.65
Weight on drivers, tons	240	225
Cost of repairs per 100 tons locomotive weight on drivers, cents	25	6.52

Including all engine service charges, the facts available give foundation for the claim that electric locomotives of the largest type can be maintained for 25 per cent to 30 per cent of the upkeep cost of steam engines operating in similar service.

As to fuel saving effected by steam railway electrification, estimates of electrical engineers have been called extravagant by steam engine advocates. Fuel economy figured prominently among the reasons leading up to the replacement of the steam engine on the Chicago, Milwaukee & St. Paul Railway, as brought out by a careful analysis of the performance of the steam engines then in service.

The following runs are chosen to bring out most strikingly the inherent disadvantages of operating a steam engine over a single-track mountain-grade division: The run of 111.1 miles from Harlowton, elevation 4,162 ft., to Three Forks, elevation 4,066 ft., over the Belt Mountan divide at Loweth, elevation 5,789 ft.,

TABLE IV—FUEL COMPARISON, SHOWING STANDBY LOSSES

		Steam	Electric
Doing useful work, lb.		23,640	8,100
Making up fire, lb.	1,535		
Delay at Harlowton, lb.	2,270		
Held up at Lennep, lb.	394		
Held up at Loweth, lb.	128		
Held up at Dorsay, lb.	230		
Fire, banked 9 hr., lb.	1,425		
Coasting down grade, lb.	3,060		
Total standby losses, lb.		9,042	
Regenerative braking, lb.		.....	1,430
Total net coal, lb.		32,682	6,670

was made by steam with 871 tons trailing load in twenty-six cars and by electric locomotive hauling sixty-four cars weighing 2,762 tons. The accompanying diagram shows the result reduced to a common basis of 1,000 gross tons moved, including the locomotive and tender weight. The running speed of the electric train was but slightly higher than the steam and the additional correction in the power demand rate of the former is made proportional to the lower speed. Both runs are therefore shown as made in identical time on the basis of 1,000 total gross tons moved in each instance. The measured values of electric locomotive input were raised to the value of there-phase energy purchased to cover a total of 32 per cent of purchased energy lost in transmission and conversion, and the kilowatt-hours so obtained were reduced to coal equivalent in the ratio of 2½ lb. of coal per kilowatt-hour.

While the electric locomotive demands power only when in motion, the steam engine requires coal whether doing useful work, standing idle or coasting down grade. In fact, the standby losses were such a large percentage of the total coal consumed that a careful record was kept of their several amounts, as may be seen by referring to Table IV.

The run of a more modern steam engine would have effected a material reduction in the 23,640 lb. of coal burned in doing useful work, but the amount of coal wasted in standby losses (9,042 lb.) might have been duplicated or even possibly increased with larger grate area. As standby losses constitute so large a proportion of the total coal burned (27½ per cent in this instance) it is apparent that enormous economies over the simple engine tested must be realized in the modern superheater and other improvements since introduced to offset in part the high inherent efficiency of the electric locomotive.

TABLE V—ANALYSIS OF STEAM AND ELECTRIC RUNS, HARLOWTON TO THREE FORKS, IN UNITS PER 1,000 TONS MOVED

	Steam	Electric
Kilowatt-hours at driver rims	2,038	2,038
Horsepower-hours at driver rims	2,625	2,625
Coal per horsepower-hour at driver rims, lb.	9.02	*3.09
Credited regenerative braking, lb.	....	0.55
Standby losses, 27½ per cent, lb.	2.47	....
Total coal per rim horsepower-hour, lb.	11.49	2.54

*Measured at power house; includes locomotive losses and 32 per cent transmission and conversion loss.

The commonly used unit measurement of pounds of coal per 1,000 ton-miles is at best a very rough and unstable comparison of steam engine runs over different profiles, variable quality of fuel and operating conditions. A truer understanding of what takes place under the engine boiler may be shown by continuous records of coal burned, tons moved, profile, delays, etc., all reduced to pounds of coal burned per useful horsepower-hour of work done at the driver rims with segregation of the many standby losses, as in Table V.

It would be a simple matter to carry through a series of runs over the electrified zones of the C., M. & St. P. with a modern Mikado equipped with up-to-the-minute fuel-saving devices and thus provide the necessary data to draw direct comparisons with the electric locomotive. Such tests with modern steam equipment would undoubtedly discredit the above comparison based upon the economies of six years ago and might lead to something approximating the blend of fact and theory shown in table VI. This table is based upon actual electric locomotive performance, Harlowton to Three Forks, coal taken at 2½ lb. per kilowatt-hour at assumed steam power station. Steam engine values are based upon the known working efficiency of a Mikado equipped with superheaters but penalized with the same standby losses actually determined with a simple engine tested Harlowton to Three Forks and given in Table IV.

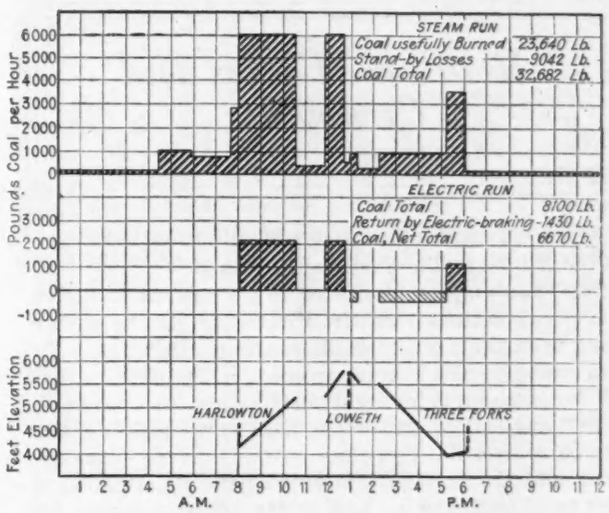
TABLE VI—THEORETICAL COMPARISON OF MODERN STEAM AND ELECTRIC LOCOMOTIVES, HARLOWTON TO THREE FORKS

	Mikado	Electric
Type	2-8-2	4-4-4-4-4-4
Weight on drivers, lb.	240,000	450,000
Weight engine and tender, lb.	480,000	568,000
Tractive effort, 18 per cent coefficient, lb.	43,200	81,000
Trailing tons, 1 per cent grade	1,420	2,836
Horsepower-hours at driver rims	4,360	8,200
Coal per indicated horsepower-hour, lb.	3	....
Coal per driver, horsepower-hour, lb.	3.75	....
Standby loss, test result, lb.	9,042	....
Standby loss, per horsepower-hour, lb.	2.15	....
Total coal per driver, horsepower-hour, lb.	5.90	....
Coal at power house, per kilowatt-hour, lb.	....	2.5
Coal at power house, per horsepower-hour, lb.	....	1.86
Coal at locomotive driver, per horsepower-hour, lb.	....	3.09
Coal credit due regeneration, lb.	....	0.55
Net coal at driver per horsepower-hour, lb.	5.90	2.54
Total net coal, lb.	24,800	20,900
1,000 trailing ton-miles	157,500	314,000
Coal per 1,000 ton-miles, lb.	158	66.7
Ratio coal burned	2.37	1

In view of all the facts a broad statement may be made that the general adoption of the electric locomotive would probably result in saving fully two-thirds the fuel now burned on present steam engines and possibly one-half the amount of fuel necessary to steam engines of the most modern construction.

The superior operating advantages of the electric locomotive are admitted by many who believe the first cost to be prohibitive, largely due to the necessary trolley construction, copper feeders, substations, transmission lines, etc. Such auxiliaries do add an amount that may equal the electric locomotive expense and the task of proving the electric case is not made easier by the fact that steam engine facilities are already installed and may have little or no salvage value to offset new capital charge for electrification.

Comparing the cost of equivalent steam and electric



COAL CONSUMPTION COMPARISON ON IDENTICAL RUNS BY STEAM AND ELECTRIC LOCOMOTIVES

motive power, it is apparent that on the basis of the same unit prices for labor and material the first cost is approximately the same. While electric locomotives cost possibly 50 per cent more than steam for equal driver weight, the smaller number required to haul equal tonnage may quite offset this handicap, especially with quantity production of electric locomotives of standard design.

No discussion of electric railway economies would be complete without comment upon the increased value of real estate brought about by terminal electrification. Not only is neighboring real estate benefited thereby, but the "air rights" over the electrified tracks may become so valuable as to largely pay the cost of the change from steam. With the work but partly finished the Grand Central Terminal district is already a remarkable example of the indirect benefits derived from electrification.

Some of the principal advantages claimed for the electric as compared to the steam locomotive may be briefly stated as follows:

1. No structural limits restricting tractive effort and

speed of electric locomotive that can be handled by one operator.

2. Practical elimination of ruling grades by reason of the enormously powerful electric locomotives available.
3. Reduction of down grade dangers by using regenerative electric braking.
4. Very large reduction in cost of locomotive maintenance.
5. Very large saving of fuel, estimated as two-thirds the total now burned on steam engines in operation.
6. Conservation of our natural resources by utilizing water power where available.
7. Material reduction in engine and train crew expense by reason of higher speeds and greater hauling capacity.
8. Increased valuation of terminal real estate following electrification.
9. Increased reliability of operation.
10. Material reduction in operating expense due to elimination of steam engine tenders and most of the company coal movement, the two together expressed in ton-miles approximating nearly 20 per cent of present gross revenue ton-mileage.
11. Large reduction in effect of climatic conditions upon train operation.
12. Postponement of immediate necessity for constructing additional tracks on congested divisions.
13. Attractive return on cost of electrification by reason of direct and indirect operating savings effected.
14. Far-reaching improvements in operation that may revolutionize present methods of steam railroading.

Readers' Views and Comments

Graphical Calculation of Illumination

To the Editor of the ELECTRICAL WORLD:

SIR: You may be interested in a short cut in illumination calculations recently worked out by the writer, based upon the use of the illumination rule.*

In order to check up a prospective illumination lay-out for uniformity of light distribution, the "point by point" method is sometimes used. In applying this scheme representative points on the working plane are taken and the vertical intensity of the illumination at each point is found by adding the separate intensities from all lamps which contribute an appreciable amount. In this work the illumination rule is very convenient. The rule is laid off to the same scale as the lay-out being checked, and at various points the vertical intensities due to one lamp or lighting unit, at corresponding horizontal distances, are marked.

The vertical intensity of the illumination at any point may then be determined by placing one end of the rule at the point and reading the intensity due to each lamp that the rule includes as it is turned through a complete circle. The sum of all such readings is the total intensity at the point, due to all lamps. This process repeated for all of the points selected gives an indication of the uniformity of the illumination.

In determining the intensity at various points on the rule, the following formula is used:

$$I = \text{Cp. } \cos^3 \theta / H^2$$

In which

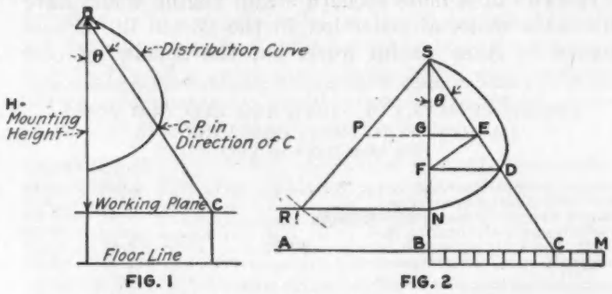
I = intensity of illumination at any given point in foot-candles (see Fig. 1).

Cp. = candlepower of the lamp in the direction of the point.

H = distance of the lamp above the working plane in feet.

θ = the angle included between the normal to the working plane and a line drawn from the lamp to the point.

In order to reduce the calculations involved in the construction of the rule, the accompanying graphical solution has been devised.



FIGS. 1 AND 2—BASIS FOR GRAPHICAL SOLUTION

Referring to Fig. 2, draw an arbitrary base line AM. Draw SB perpendicular to AM equal to the mounting height H to same scale as point by point rule BM being made. Draw a distribution curve SDN to any convenient scale. From N draw RN parallel to AM. From S as a center and with a radius equal to the intensity at B to any convenient scale describe an arc cutting RN at R: draw RS. For any point as C draw SC. From the intersection of SC with the distribution curve, draw DF parallel to BM. Then draw FE perpendicular to SC, then GE parallel to BM. Project GE to RS and read intensity for point C at P, etc.

Proof of the method:

SD = candlepower in the direction of C.

SF = candlepower in the direction of $C \times \cos \theta$.

$SE = SF \cos \theta =$ (cp. in direction of C) $\times \cos^2 \theta$.

$SG = SE \cos \theta =$ (cp. in direction of C) $\times \cos^3 \theta$.

Since the intensity varies as (cp.) $\times \cos^3 \theta$,

Intensity at $C = (SG/SN) \times$ intensity at B. But since by similar triangles $SP/SR = SG/SN$, intensity at $C = SP/SR \times$ intensity at B. But by scale $SR =$ intensity at B, therefore intensity at $C = SP$, to scale.

In order to avoid confusion in the use of this graphical method, the intensity at each point should be scaled and recorded on the rule before another point is taken up.

K. S. WEAVER,
Philadelphia. University of Pennsylvania.

*See "Factory Lighting," by C. E. Clewell, p. 18.

Dependability of the CO_2 Recorder

To the Editor of the ELECTRICAL WORLD:

SIR: We noted an interesting leader in the issue of Oct. 9 on boiler-room instruments. Toward the close the author says that it is unfortunate that the CO_2 recorder "is, generally speaking, a somewhat delicate piece of apparatus and none too responsive to changes resulting from rapidly changing firing conditions." Is it possible that he was thinking of the old-style CO_2 recorder with a multiplicity of glass bottles, rubber tubes and other fragile parts? A recorder which does not have these disadvantages was designed by a practical power-plant engineer who had suffered the engineer's usual experience and is now built in our own shops. It is very rugged and dependable and can make a complete analysis every two minutes that should surely take care of "rapidly changing firing conditions."

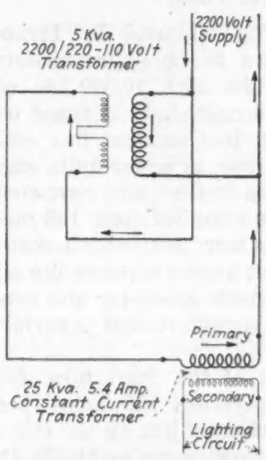
W. ELSWORTH LAWSON,
Foxboro, Mass. THE FOXBORO COMPANY, INC.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Increasing Current of Constant-Current Transformer in Emergency

BY BOOSTING the primary voltage 10 per cent the current of an overloaded constant-current transformer was increased from 5.2 amp. to its normal output of 5.4 amp. in a recent emergency of an Eastern power company. This overloading resulted from some changes made on the lighting circuit which this transformer fed. When the operator tested the circuit he found that the transformer was overloaded so that the primary and secondary coils came together and the amperage was only 5.2 instead of 5.4, owing to the line construction department having cut in too many lights on the circuit.



CURRENT RAISED BY BOOSTING PRIMARY VOLTAGE

In order to avoid a delay in lighting this circuit the following temporary arrangement was made: A 5-kva., 2,200/220-volt transformer which was not in use was connected in the primary leg of the circuit as shown in diagram so as to "boost" the primary voltage 10 per cent. When the circuit was again made alive the coils stood about 2 in. (5 cm.) apart, giving the correct amperage of 5.4. This required only a few minutes so that there was no delay in lighting the circuit. Since that time the same arrangement was used on another circuit while waiting for a larger transformer which had been ordered.

Ampere, N. J. EUSTACE C. SOARES.

Rules for Connecting Service Switches and Meters

INSTRUCTIONS regarding proper installation of customers' services, ground connections and meters recently issued to employees of the Central Maine Power Company, Augusta, are as follows:

1. Meters should be securely fastened to the wall with three screws and not hung on one, as many are at present.

2. The practice of putting two separate circuits into meter terminal chambers instead of setting two cut-outs should not be allowed.

3. It should be remembered that all General Electric and Westinghouse meters run counter-clockwise or from the left to the right when facing meter. Sangamo and Fort Wayne meters run from right to left or clockwise.

4. The grounded side of the service should never be connected to the outside terminal of the meter; that is, the grounded wire should never be the one to go through the meter field.

5. If the inside men when doing new work would always see that the left-hand wire on their entrance switch is the grounded wire, it would never be necessary to cross these leads, as the meter is always placed to the right of the switch. It should be an easy matter to bring the grounded wire out of the conduit so that this will come right.

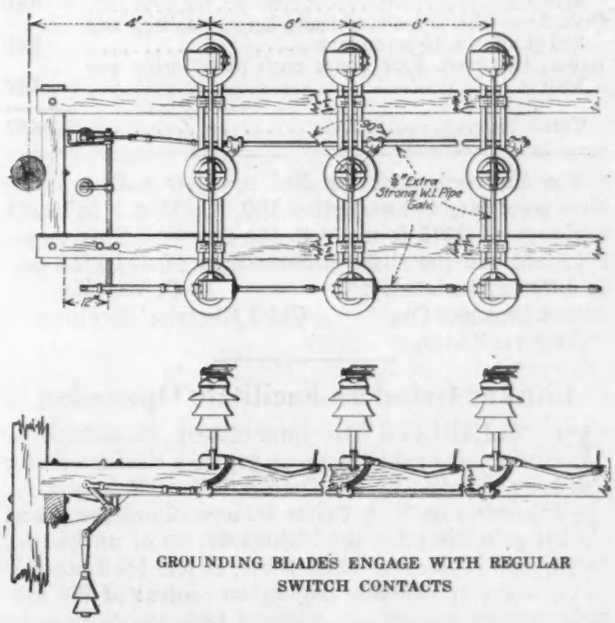
6. The practice of testing for the grounded wire by touching each line wire to a pipe should not be allowed—a test lamp should be used.

7. Care should be taken that it is the middle wire of a 110-220-volt transformer hitch that is grounded.

GEORGE S. WILLIAMS, General Superintendent.

Combined Outdoor Switch and Grounding Device

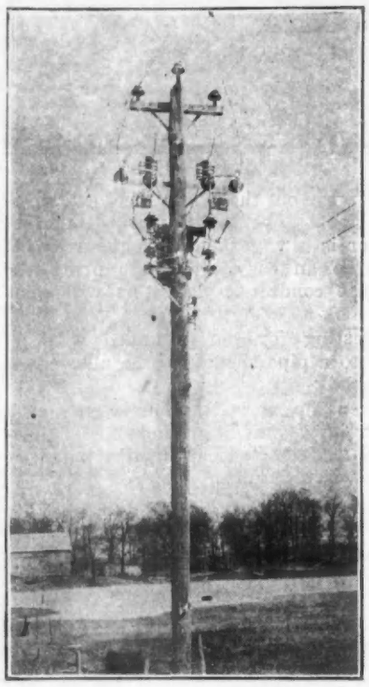
OWING to the adverse weather conditions near the Great Salt Lake and the accumulation of salt and cement from the chemical works and cement mills of that region, the Utah Power & Light Company has developed the equipment shown for use on its 44-kv. lines. The switch is made for mounting between poles and is assembled as a complete unit. Two operating levers are provided, one for controlling the switch and the other for controlling the grounding device. These are interlocked so that the switch cannot be grounded while it is closed. The rack is made of extra-heavy galvanized pipe, and the contact jaws are shielded for protection against dirt. The grounding switch is an integral part of the device and safely grounds all phases simultaneously, engaging with the regular switch contacts.



GROUNDING BLADES ENGAGE WITH REGULAR SWITCH CONTACTS

P. P. ASHWORTH,
Distribution Engineer.
Utah Power and Light Company.
Salt Lake City.

Company Supplies 2.5-Kva. Rural Transformer Installation for $375



13,200/110-220-VOLT SINGLE-PHASE TRANSFORMER INSTALLATION

FOR $375 the type of customer's transformer installation shown in the accompanying illustration is being supplied by the Miami Valley Electric Company of Sidney, Ohio, one of the Albert Emanuel Company properties. The installation is simple and is easily and cheaply installed. It consists of air-brake switches operated from the ground, horn-gap and resistance lightning arresters, choke coils, expulsion fuses and transformer. The approximate cost of a typical installation on a 13,200-volt line to supply 110-220-volt, single-phase service is shown in the following itemized tabulation of materials and labor:

2½-kva. transformer	$135.00
Switching equipment and lightning protection	160.00
Material for grounding neutral and lightning arrester	2.50
One three-wire secondary rack, bolts, washers and 300 ft. of No. 10 secondary	5.00
Labor, two men, four hours each at 50 cents per hour	4.00
Total	$306.50

For the equipment installed complete with a three-wire secondary not exceeding 100 ft. (31 m.) in length a charge of $375 is made to the farmer. This covers overhead and the slight difference in construction cost in different installations.

D. O. VAUGHN,
Chief Electrical Engineer.
Albert Emanuel Co.,
New York City.

Clinker Grinders Facilitate Operation

TO ELIMINATE the intermittent disposition of clinkers and ashes by dump grates a clinker grinder has been installed by the Detroit Edison Company for use in connection with Taylor stokers. Since the use of clinker grinders gives the highest degree of uniformity in furnace conditions at all times, it has been possible to cut down appreciably the carbon content of the ash. The clinkers and ash are removed from the furnace by the rotation of a toothed grinder, the clinkers being crushed between the grinder and a movable crusher plate. The clearance between the crusher and plate can be adjusted to suit the character of fuel and is a help to the fireman in keeping furnace conditions uniform. At present the grinder is driven by connection to the long-stroke link on the end retorts of the stoker through a ratchet wheel connected to the end of the grinder shaft. The fact that the speed is limited by the stoker speed is a disadvantage when slow-burning coal with a high ash content is used, because the ash cannot be removed fast enough to keep the grates clear of clinkers. This trouble is to be eliminated by an individual motor drive which can be operated at any speed which may be required.

With the present poor coal the grinder teeth wear rapidly. The shell, however, remains in good condition and the removable teeth may be replaced by new ones. The data given were presented in a paper by R. G. Filger of the Detroit Edison Company at the convention of the Michigan Section, N. E. L. A., at Ottawa Beach.

Relation of Lubricating Oil Used to Generator Size

THE amount of lubricating oil used by turbo-generators has been found to be approximately 0.298 gal. (1.12 l.) per hour for each 10,000 kw. of machine rating. The accompanying chart is based on this figure with the realization that straight line consumption curves may not hold true, as larger units may not use oil directly in proportion to their size compared to smaller units. Records were compiled from 108 machines, and although the results were somewhat irregular and in some cases it was not known whether the oil used included that supplied to both generator and turbine, yet the rates were closely enough related to permit using the average.

To illustrate the application of the chart take, for example, a 4,000-kw. unit, operating 120 hours per week. Following along the horizontal line on the chart to the number 4, and then following up vertically to where this vertical line cuts the inclined line marked 120, and following this intersection to the left, we find that such a machine should use fifteen barrels of oil a

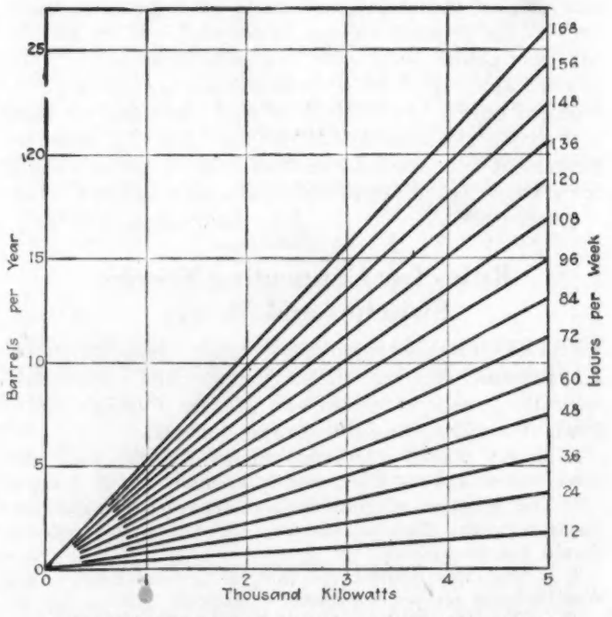


CHART FOR ESTIMATING ANNUAL OIL CONSUMPTION OF TURBO-GENERATOR SETS

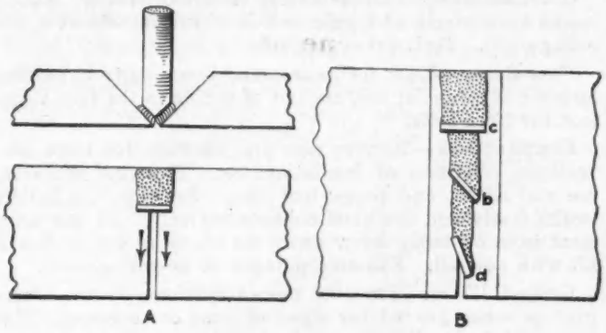
year. Although the chart is not intended to give the results with great accuracy, yet in the absence of other data it will give an idea of the estimated yearly consumption of a new machine.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Flat Welding Electrode Requires Less Skill

LESS time and skill are required for welding seams with an electrode in the shape of flat wire than with the common round electrode. The flat electrode, *A*, assumes a "V" shape, corresponding to the V in



FLAT ELECTRODE DOES NOT REQUIRE WEAVING

which the weld is being made, owing to the fact that the arc centers at those points closest to the metal and thus melts off the electrode to a uniform distance from the welded metal. This relieves the operator from the necessity of skillfully weaving the electrode from side to side and down into the bottom of the notch. He has only to move the electrode along the cam and feed it into the arc as it melts off. After the weld is completed in the bottom of the notch the electrode is used as shown in *B* to produce a broad, uniformly flat weld.

When using this electrode it is necessary for a welder to carry only one size and use it either flat or edgewise for wider or narrower seams. The wire is also particularly fitted for use with automatic welding machines since it will give broad runs without side motion.

Quasi-Arc Weltrode Company, Brooklyn, N. Y.

W. W. PALMER, Electrical Engineer.

Removal of Shunt from Interpole Winding Improved Operation

IN AN obstinate case of trouble with an old interpole railway machine many attempts to get good operation with an interpole shunt were unsuccessful. Perfect operation was finally obtained by removing two turns from each interpole coil and operating without any shunt around the interpoles.

This was one of the earlier machines, on which interpoles were often wound with the magnetic strength of the interpoles too great, and this was reduced to the correct value by placing shunts around the interpoles. This serves well enough for ordinary loads, but for fluctuating loads, such as street railways or steel-mill duty, the results are not satisfactory. The reason for this is that the shunts are practically non-inductive while the interpole windings are inductive. Hence when a sudden change in load occurs most of the current passes through the shunt and the current in the interpole circuit is insufficient to maintain the interpole strength at the correct value for the increased armature current. Consequently sparking occurs at the brushes.

JAMES DIXON.

Reliance Electric & Engineering Company, Cleveland, Ohio.

Rewinding a Two-Phase Motor for Three-Phase Operation

CHANGING a two-phase, six-pole motor to operate at the same speed on three-phase energy of the same voltage and frequency was recently accomplished by the writer by rewinding in the method here outlined. The motor was a 100-hp., 220-volt, two-phase, 60-cycle, six-pole, 1,120-r.p.m. squirrel-cage induction motor. The two-phase winding consisted of ninety-six coils, in two layers with eight turns of three No. 10 double-cotton-covered wires per coil, pitch 1 to 12, connected six-parallel, eight coils per group, in twelve groups. The total two-phase winding in series was good for $2 \times 6 \times 220 = 2{,}640$ volts, with a chord factor of 0.88185. The voltage per phase for three-phase would be $2{,}640 \div 3 = 880$ volts per line for a series-delta connection. Although $880 \div 220 = 4$, a four-parallel connection cannot be had on a six-pole motor. A two-parallel connection, however, would give $880 \div 2 = 440$ volts, and to get 220 volts the number of turns per coil could be decreased 50 per cent and the cross-section doubled. The equation $2{,}640 \div 3 = 880$ does not take into consideration the distribution factor, which is 0.905 for a two-phase and 0.995 for a three-phase motor. Taking this into account, the corrected three-phase voltage would be $(0.955 \div 0.905) \times (2{,}640 \div 3) = 1.0552 \times 880 = 928.576$ volts, and with a full-pitch winding the three-phase voltage would be $928.58 \div 0.882 = 1{,}052.81$ volts.

A chord factor was accordingly chosen which would decrease the voltage to 880. This chord factor is $880 \div 1{,}052.81 = 0.8349$, which is the sine of the angle 56° 36′ nearly. Therefore the coil must span $2 \times 56° 36′ = 113°$ in electrical degrees. But one slot spans $180° \div$ (16 slots per pole) $= 11.25°$. Therefore the coil pitch will be $113° \div 11.25° = 10$ slots, or a pitch of 1 to 11. This pitch gives an exact chord factor of 0.83147); thus the three-phase voltage $= (1{,}052.81 \times 0.83147) \div 4 = 218.84$ volts, which is close enough to 220 volts for satisfactory running.

The stator was therefore rewound for three phases with ninety-six coils having four turns of six No. 10 double-cotton-covered wires in parallel per coil, pitch 1 to 11, connected two parallel delta, thirty-two coils per phase, and sixteen coils per circuit. The grouping for ninety-six slots, three phases and six poles was odd. A top-to-top connection was used, the coils being

grouped and arranged as follows: 6-5-5, 5-6-5, 6-5-5, 5-5-6, 5-6-5.

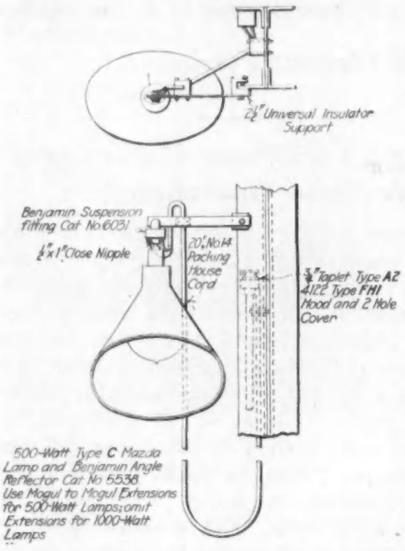
After this change had been made the motor operated satisfactorily.

A. C. ROE.

Detroit, Mich.

Industrial Lighting Fixture Which May Be Raised, Lowered or Detached

A LIGHTING unit which may be raised or lowered on its support, or even detached for use as a portable extension lamp, is employed at the Hog Island shipbuilding yards. This fixture, as may be seen from the accompanying drawing, is held on the flange of a structural-steel column by means of a strap-iron arm bolted to a universal 2½-in. (6.3-cm.) insulator support. By loosening the bolt in the insulator support the lamp may be raised to any desired height, or may be detached altogether and transported to any nearby work where it may be required. The lamp is enclosed in a Benjamin angle reflector No. 5,537 and hung on the end of the arm by means of a Benjamin suspension fitting No. 6,031. Mogul extensions are used for 500-watt lamps, but no extension is required with 1,000-watt lamps. Electrical connection is made through 20 ft. (6 m.) of flexible No. 14 packing-house cord.


2½" Universal Insulator Support
Benjamin Suspension Fitting Cat. No. 6031
½ x 1" Close Nipple
20' No. 14 Packing House Cord
¾" Taplet Type A2 412 Type FHI Hood and 2 Hole Cover
500-Watt Type C Mazda Lamp and Benjamin Angle Reflector Cat. No. 5536. Use Mogul to Mogul Extensions for 500-Watt Lamps; omit Extensions for 1000-Watt Lamps

LAMP MAY BE ADJUSTED TO ANY HEIGHT OR DETACHED FOR USE AS PORTABLE LIGHT

Inspection System Which Keeps 1,200 Motors Running

TO "KEEP the wheels turning" the maintenance system developed in a Canadian textile mill has been found successful with 1,200 motors ranging from ¼ hp. to 250 hp. in size. Inspections are made as follows:

Motors.—Very little inspection can be made of motors when in position, but in the open type the air gap may be noted. See if oil is creeping along the shaft and being thrown on the stator coils, or if there is any vibration. Oilers must notify the electrical department when a motor is hotter than usual. Motors are thoroughly overhauled once a year, for which purpose they are carried to the shop, taken apart, cleaned, the bearings attended to and the motors revarnished and tested. If a spare machine is not available, the overhauling is done at the week end. In very dirty places it is advisable to drain the oil from bearings every six months. If the oil is clear after it has settled some time, it can be used again. In textile mills look out for cotton fluff forming a siphon. See that the oil rings revolve freely; try turning them with a lead pencil.

Control Equipment.—Isolating panels, circuit breakers, compensators, controllers, resistors, etc., are examined and overhauled every three months, for which purpose all apparatus is made dead. In cases which call for frequent stopping and starting, the apparatus is examined every six weeks. A record of these examinations is kept. Inspection of control apparatus is classified as follows:

Isolating Panels.—Examine for loose connections, signs of arcing or burning. Unscrew plug to see if it sticks and if very tight put vaseline on the thread. Test for slack bolts holding panel on frame.

Automatic Circuit Breakers.—Look for loose connections, for signs of heating of leads or stems of contacts and for bad contacts. If contacts are burned, file and adjust; if too badly burned, renew them. Examine oil for sediment and height. Examine time element for loose nuts, screws, etc. Remove dashpot, examine needle valve, see if oil is clean and at right level, replace dashpot, close breaker and test operation.

Overload Relays.—Same as for circuit breakers. Examine silver contacts of toggle switch which operates the no-voltage coil. Test.

Fuse Boxes.—Look for loose connections, signs of heating by color of contacts; test amount of spring in the fuse clips; look for loose bolts.

Compensators.—Remove case and examine for loose connections, condition of insulation, etc. Examine contacts; file and adjust and renew bad ones. See that the handle works freely and the pawl engages correctly. If any sediment is in oil tank, throw away old oil, clean out tank and fill with new oil. Examine plunger of no-voltage coil.

Ground Wires.—Examine the connections on the water pipe or other ground for signs of rust or corrosion. Examine whole length of ground wire.

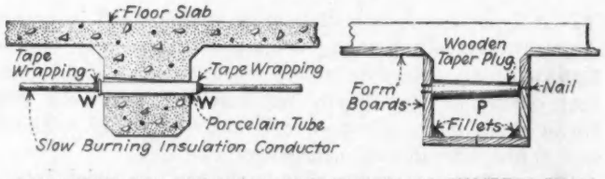
Glasgow, Scotland.

H. E. WOOD.

Running Open-Work Conductors Through Concrete Beams

IN FACTORY buildings of reinforced concrete there are sometimes a number of open-work conductors to be run along the ceiling of the lower floor at right angles to the direction of the beams, and it is desired that these conductors shall pass through the beams, rather than be supported on the lower faces. This can be accomplished by nailing a conical taper plug in the beam forms, before the concrete is poured, at each place where a conductor is to pass through (*P* in the illustration). Then, after the concrete has set, the plug is driven out. Each of the holes through the beams is bushed with a porcelain tube. The tube is held from slipping along the conductor by tape wrappings at each end.

An open-work conductor run arranged as shown should be firmly held on strain insulators, which take the tension at each end of the run. A tightening arrangement of some sort should also be provided in conjunction with the strain insulators. The porcelain tubes through each beam simply insulate the conductor from the beam and, obviously, do not prevent it from "slacking back."



CONDUCTOR RUN THROUGH HOLE FORMED IN CONCRETE BEAM

Method of preparing form before pouring concrete is shown at right.

JAMES B. BOND.

Omaha, Neb.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Present Cost of Materials Compared with 1915 Prices

A COMPARISON of the costs of materials and supplies used and labor employed by a public utility as between July 1, 1915; July 1, 1918, and July 1, 1920, was brought out in a recent hearing before the Railroad Commission of Georgia. The accompanying table includes the costs of labor and material which were recognized by the commission as greatly increasing operating costs over those of pre-war times.

COSTS OF COMMODITIES AND MATERIALS F.O.B. ATLANTA AND RELATIVE COST OF LABOR

	1915	1918	1920
Coal, per ton	$2.56	$5.01	$11.80
Gas oil, per gal	0.046	0.091	0.14
Copper, per lb	0.23¼	0.27½	0.24½
Steel wire, per lb	0.024	0.037	0.039
Standard poles, each, set	10.50	14.00	20.00
Cross-arms and brackets	0.58	0.94	1.67
Yellow pine lumber, per 1,000 ft.	16.00	34.00	55.00
Insulators	0.95	2.24	2.80
Creosoted ties, each	0.69	1.07	2.02
Cement, per bbl	1.25	2.18	4.50
Linemen, per hour	$0.30—$0.31—$0.36½	$0.31—$0.40	$0.57—$0.63½
Common labor, per hour		.20— .21½	.35
Machinists, per hour	.39— .44	.50	.83 .85
Carpenters, per hour	.27— .32	.42— .45	.70— .80
Painters, per hour	.18— .39	.25— .48	.63— .80

Increasing Salesmen's Salaries Reduces Cost of New Business

AT THE end of the year 1919 the sales department of the Narragansett Electric Lighting Company, Providence, R. I., was faced with the problem of increasing the remuneration of its lighting salesmen. At the same time it was not wise to increase the cost of getting business. Previous to this year the salesmen had been paid on a salary and commission basis. They wanted an increase for 1920 and felt sure that they would show better results if they received more money for the business secured. After discussing the matter pro and con, the following system was adopted:

A salary equal to the salary and commission earned in 1919 was fixed for each salesman. A quota equal to the amount of business he secured during the year 1919 was then named for each man, the year's business being divided by twelve to arrive at the monthly quota. For each new meter over and above his quota the salesman is paid $3. Renewals, change of names and the like are not classed as new meters. Only entirely new installations, resulting from new wiring jobs, are so considered.

In addition, the salesmen must look after routine business, for which they receive no direct remuneration aside from their salaries. If this business does not receive adequate attention, it is understood that the territory will be divided and part of it given to a new man. This naturally would reduce the salesman's earnings, and it has been found that he will not become so enthusiastic in obtaining new business as to forget about the old.

No man is paid any commissions until he has met his quota. Upon failure to make it one month, the difference between the business actually secured and the amount stipulated is added to his quota for the following month. In other words, each man must earn his salary before he receives a commission. This arrangement protects the company against an increase in the cost of getting business, and it is fair to the salesman because it is based upon actual past performance. This method has eliminated most of the serious disadvantages of the quota system, and in no case is the quota so high as to discourage the salesman.

Although perfection is not claimed for the system, it has brought results. There has been no change in the personnel of the department. The year 1919 showed a good record, but by May, 1920, more new business had been secured than during the whole of 1919. It is expected that the new business for the year 1920 will amount to 250 per cent of that of 1919.

The salesmen have received considerably more money than they would have received by a raise in salary or an increase of commissions without a quota to which they must work in order to earn additional money. The average amount paid to all the men is about 50 per cent more than was paid to them in 1919, but the actual cost of getting the business has been reduced about 25 per cent.

Light Bills Used to Advertise Civic Enterprises

..Fair Days..
August 31, September 1, 2, 3
Ninth Annual
Larimer County Fair
at LOVELAND, COLORADO
The Big Exposition of the Agricultural Empire of Northern Colorado
J. W. THOMPSON, Secretary

ADVERTISING WHICH GAINS COMMENDATION OF PUBLIC

THE Western Light & Power Company of Colorado is using the back of the bills which it sends to consumers to advertise various civic undertakings held for the public good. As an example the company's district office at Boulder advertised the Larimer County Fair on the back of bills that reach the customers in that territory. In this manner the information is carried to about 20,000 people. This is one of the many ways in which a public utility can gain favor with its consumers and at the same time help to promote civic and county pride.

New Orleans Company Makes Merchandising Department Profitable

CENTRAL-STATION executives and commercial managers who have asked the question "Does my merchandise department pay and what method should be employed to secure the best result?" will be interested in the following letter from W. E. Clement, commercial agent of the New Orleans (La.) Railway & Light Company:

"Our policy has always been to operate our merchandise department at a profit; in fact, the profits very nearly pay for the operation of the entire commercial department. Practically everything in the electric appliance line is carried. At one time we sold some lighting fixtures, such as portable lamps, domes, etc., but have discontinued this practice and for several months past have sold only labor-saving and household convenience appliances.

"An extensive salesroom is maintained in which we display all of the appliances carried. An atmosphere of activity is given to the salesroom by demonstrations of the different appliances. The demonstrations are varied from time to time to avoid monotony. Most of our sales people are young men, although in the salesroom we employ two or three young women. Outside salesmen handle routine business, obtaining applications for light and power, collecting deposits and other matters incident to giving good service, for which they are paid a nominal salary of from $50 to $65 per month. In addition to this salary salesmen receive a commission of 10 per cent on all appliances and tungsten lamps which they sell.

"Our relations with the contractors and dealers are most satisfactory as we confine our sales strictly to electric appliances, most of which are purchased from local electrical jobbers. The company does no house wiring whatsoever, nor does it sell electrical supplies, all of this business being referred to the contractors and dealers. By this arrangement we have been able to obtain and hold the good-will of every one engaged in the electrical business in our city.

"In order to popularize the use of electric appliances we have found it advisable to maintain a repair department in which we repair customers' appliances. No work is done free of charge, with the exception that we make good such guarantees as cover appliances for a certain length of time. All other repair work is charged for on the basis of cost plus a reasonable profit. Nearly all appliances are sold on the installment plan, 5 per cent being added to the cash sale price to cover interest in handling the account when the deferred-payment plan is desired. On washing machines and the higher-priced appliances we have a plan under which we add to the selling price $1 per month for the period over which the customer desires installment payments to run. The limit under this plan is fifteen months.

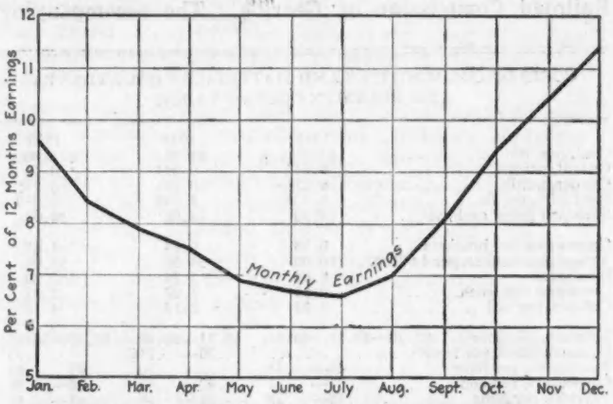
"A cost-accounting system is maintained whereby our profit or loss can be ascertained easily and accurately. All merchandise is carried in stock and charged to operating account as it is sold. The sales are credited daily to this account, so that at the end of the month the auditor can easily render a statement showing results of operation for the month. Once a year an inventory is taken of all stock, discrepancies are rectified and all obsolete appliances are disposed of, the resulting loss being charged off."

Mr. Clement has had charge of the sales department of the New Orleans Railway & Light Company for a number of years, and his comments are made after a wide experience under varying conditions.

Estimating Utility Earnings from Graphic Records

AT THE Kineo (Me.) convention of the New England Geographic Division, N. E. L. A., W. H. Blood, Jr., of Stone & Webster, said that in his work he has frequently been called upon to make estimates of earnings and expenses when the earnings for part of a year or only a month or two were available. To arrive at the proper multiplier the following method was pursued:

Various lighting companies were grouped as to earnings, there being about 200 companies all told. The



DATA ON AVERAGE MONTHLY EARNINGS OF 200 COMPANIES

earnings were ascertained by months and the percentage each month's earnings bore to those of the year were plotted for all the companies on the same sheet, after which a mean was drawn. The diagram shown herewith represents this mean, and the table accompanying it was deduced from the values taken from this curve.

Column 3 of this table, headed "Multiplying Factor," gives the multiplier to be applied to any particular month's earnings to give the yearly earnings. Thus, the January earnings are 9.6 per cent of the year's earnings, and if a certain company earned *A* dollars in January the yearly income would be $A \times 10.5$. Column 4 gives the multiplier to be applied to the accumulated

RATIO OF MONTHLY EARNINGS TO TWELVE MONTHS' EARNINGS

	Per Cent of 12 Months		Multiplying Factor	
	1 Month	Cumulative	1 Month	Cumulative
January	9.6	9.6	10.5	10.48
February	8.4	18.0	11.9	5.57
March	7.9	25.9	12.7	3.86
April	7.5	33.4	13.3	2.97
May	6.09	40.3	14.3	2.48
June	6.7	47.0	14.9	2.12
July	6.6	53.6	15.1	1.86
August	7.0	60.7	14.2	1.65
September	8.1	68.8	12.3	1.45
October	9.4	78.2	10.7	1.28
November	10.4	88.6	9.65	1.13
December	11.4	100.0	8.82	1.00

earnings to and including any particular month to give the year's revenue. For example, from January to May inclusive 40.3 per cent of the year's revenue is earned. If this value is *A*, for convenience to get the probable revenue for a year we must multiply *A* by 2.48. The method of using the mean in obtaining the curve and table permits the elimination of companies where the earnings are erratic, whereas if figures alone were used the erratic companies would naturally be included.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Field Leakage in Synchronous Machines—THEO. SCHOU.—A method of analyzing and determining field leakage between poles of low-speed and high-speed synchronous machines.—*Electrical Review*, Aug. 21, 1920.

Lamps and Lighting

Distance Control of Searchlamps.—A descriptive article dealing with German methods for controlling the direction of the beam of light from searchlamps. In the German navy a system of torsion rods was used to link up the control wheel with the tipping and rotating gears on the searchlamp. However, if ordinary gear drives are used, the searchlamps when the apparatus is rotated will unintentionally carry out a tipping motion, since the tipping gears will be affected when the whole mechanism turns around. Several methods for correcting this error are described. These make it possible to have one given position of the two control handles to correspond to one and only one position of the searchlamp. A special searchlamp design for ship service is described in which two plane mirrors are used to throw out the beam of light, the searchlamp itself being placed inside the hull in a protected position and the beam of light coming up through the hollow steel mast of the ship.—*Elektrotechnische Zeitschrift*, Aug. 26, 1920.

Relative Spectral Transmission of the Atmosphere.—ENOCH KARRER and E. P. TYNDALL.—As part of the searchlamp investigation of the bureau, data have been taken on the relative spectral transmission of the atmosphere. Light from an incandescent lamp was reflected by a mirror 600 m. distant, and the intensity of this reflected light was compared, by means of a spectrophotometer, with the intensity of a beam directly from the lamp. Curves are given for three types of weather conditions—(1) clear and cold, (2) overcast with high humidity, (3) rainy. The first type shows very little selectivity. The second and third types are similar for wave lengths less than 540 μ, there being a decrease in transmission for shorter lengths. In the rest of the visible spectrum the curves of the second type present two maxima and a minimum, which are entirely lacking in the curves for rainy weather. The conclusion drawn from these curves is that the transmission of the atmosphere under the conditions prevailing during the experiments is greatest in the yellow and orange regions of the spectrum.—*Scientific Paper No. 389, United States Bureau of Standards*, July 21, 1920.

Generation, Transmission and Distribution

Efficiency of Aërials and Power Required for Long-Distance Transmission.—G. W. O. HOWE.—That portion of the total energy supplied to the aërial of a transmitting station which is dissipated in the resistance of the wires constituting the aërial, tuning coils and secondary winding of the oscillation transformer, and earth or counterpoise wires, dielectric losses, etc., are calculated by the author.—London *Electrician*, Sept. 10, 1920.

Induction Coefficients of Electric Lines.—CAPDEVILLE.—The author presents a simplified method for determining the coefficients of self-induction and mutual induction between wires which should be useful in complicated cases, particularly in problems concerning polyphase systems. The method depends on the introduction of a fictitious return conductor. Since no current flows in this conductor, it may be reduced to a line, and since no magnetic action can result from zero current, the location of the fictitious neutral appears to be arbitrary. Further consideration of certain invariants, however, discloses that the fictitious conductor may be put in one particular place only, which is defined as the "magnetic center" of the wire system. The various induction coefficients now may be expressed in terms of the distances from the respective wires to this magnetic center. Well-known three-phase formulas are derived as examples of the use of this device, applications to more complicated cases being reserved for a later publication.—*Revue Générale de l'Electricité*, July 31, 1920.

Installations, Systems and Appliances

Method of Testing Magnet Steels.—F. R. HOUSDEN.—Apparatus is described which enables a steel test bar to be brought to the saturated magnetic state in order to produce the maximum remanence and then to have the portion of its hysteresis loop in the second quadrant examined more in detail.—*Beama* (London), September, 1920.

Design of Electrical Installations for Ships.—C. H. WORDINGHAM.—The author says that for use on shipboard electric power has demonstrated its reliability. Its advantages are great, for, in addition to its convenience, adaptability and ease of manipulation, it has the further great merit of being available at any instant, whereas it is unavoidable that steam plant entails either a preliminary warming up or losses while standing. In dealing with distribution systems the author states that alternating current is inferior to direct current on shipboard, particularly on account of the danger of shock. He gives advantages of the radiating system of distribution and deals with the proper selection and protection of cables in this service.—London *Electrician*, Sept. 3, 1920.

New Electrical Precipitation Treater.—MOTOJI SHIBUSAWA and YASUJIRO NIWA.—A description and the theory of a new electrical precipitation treater, with results of experimental work in laboratories. The paper contains: (1) General description of the new precipitation treater, with glass-covered electrodes; (2) experiments of the electrotechnical laboratory, Tokyo, Japan; (3) experiments at the copper refining factory at Nikko; (4) field of practical application of the new pre-

cipitation treater; (5) theory of the new treater. An extensive oscillographic study of the treater is given in this article.—*Journal A. I. E. E.*, October, 1920.

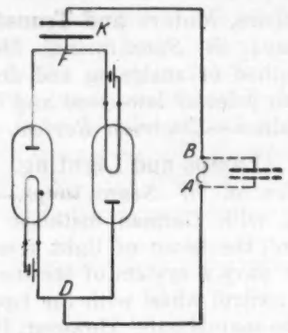
Electrophysics and Magnetism

Resistance and Constancy of Aluminum Contacts.—R. RICHTER.—The author gives a most comprehensive and detailed report of the results of a long series of systematic investigations, made at Karlsruhe, to determine the reliability of contacts between aluminum and other metals. The work covers a period of more than three years, during which time 421 screwed, riveted, twisted, soldered and welded contact specimens were investigated. The samples were arranged on wooden frames, in groups of twenty-four in series, and direct current of 10 amp. was passed through the groups. Each contact was provided with potential terminals, and the resistance was computed from observations of the voltage drop. Each set of contacts was tested by loading it for a long time with 15 amp. alternating current. Load runs were made in dry and moist air and in air containing sulphur dioxide. The contacts also were exposed to mechanical vibrations. During all these tests careful track was kept of the resistance. The screw connectors consisted of cylindrical pieces, 12 mm. (0.5 in.) in diameter and 30 mm. (1.2 in.) long with a co-axial hole for 3-mm. (⅛-in.) aluminum wire, the wire being clamped by one to three screws for each wire end. Screw connectors for aluminum wire were found reliable only when made of brass and when provided with at least three screws per wire. Screw connections of aluminum, zinc, iron and copper were tested, but proved unreliable. Welded contacts between aluminum wires were found entirely reliable. Soldered connections stood the test only when made by means of soldering connectors of solid aluminum, of cylindrical shape, similar to the screw connectors, but provided with an oblong hole in the side for pouring in the solder. It proved advantageous to cover up the aluminum solder with ordinary tin solder. Riveted aluminum-wire connections and twisted connections with and without sleeves were entirely unreliable, but riveted lug connections between aluminum wire and brass lugs seemed to have some stability. The article contains thirty comprehensive tables covering the numerical results of almost every run.—*Elektrotechnische Zeitschrift*, May 6, 13, 20, 27, June 3 and 10, 1920.

Units, Measurements and Instruments

Energetics of Telephone Receivers.—HEIICHI NUKIYAMA.—It is stated that the essential part of the mathematical theory presented in this paper consists of the power analysis in the magnetic circuit which is the main power-transforming system in telephone receivers.—*Technology Reports*, Vol. 1, No. 3. *Tohoku Imperial University*, 1920.

Improvements in Cathode-Ray Oscillographs.—ROGOWSKI.—In the cathode-ray oscillograph an auxiliary electric current gives the cathode ray a motion along the axis of the abscissa at right angles to the direction of motion given to it by the current which is to be studied on the oscillogram. If a sine current is used for the time-axis motion, the scale will not be uniform. Zenneck and Roschansky have suggested devices for giving the ray a constant velocity along the time axis. The present author proposes to use an auxiliary current of triangular wave form, obtained by means of two thermionic valves as indicated in the figure. The condenser K is charged and discharged by a source of alternating current AB, the charging current passing through one and the discharge through the other of the two valves. The impressed voltage must be so high that in either tube the saturation current is obtained almost instantly for every reversal. The condenser K then will be charged and discharged with constant current—that is, under a voltage which varies



VALVE ARRANGEMENT FOR TIME-AXIS MOTION IN CATHODE-RAY OSCILLOGRAPH

directly with time—and if the condenser voltage is impressed upon two auxiliary deflecting plates in the cathode tube, the ray will get the desired linear time-axis motion. In another article Rogowski and Glage describe some experiments with this device, and present oscillograms which show the degree of linearity obtained in the apparatus.—*Archiv für Elektrotechnik*, July 8, 1920.

Telegraphy, Telephony and Signals

Static Elimination by Directional Reception.—GREENLEAF W. PICKARD.—The author considers the possible origins of static and inclines toward a solar origin. He finds that static comes from all directions, with maximum intensity from above and maximum frequency from the horizon. The probable static wave form is a single highly damped pulse. He then describes his early work with loop directional receivers, his invention of the so-called "Dieckmann cage" and his early work in static elimination. He also gives the three-dimensional reception characteristics of linear antennas, loops and various combinations of these. The work carried on under his direction at the Otter Cliffs (Me.) receiving station is described in detail. Highly successful loop-and-antenna combinations were used in static elimination, and these are discussed with numerical results.—*Proceedings Institute of Radio Engineers*, October, 1920.

Energy Measurements in the Radiation Field of Airplane Antenna.—BALDUS AND HASE.—The radiation energy was observed by means of a stationary receiving antenna with loosely coupled aperiodic circuit. The current in the aperiodic circuit was measured by barretter and string galvanometer, and by this arrangement antenna energies down to 10^{-7} watts could be determined. A great number of measurements were made under various conditions, and the results are shown in numerous curve charts. The results seem to indicate that as far as the field energy at a reasonable distance is concerned, a hanging airplane antenna may be replaced by an oscillating dipol, whose axis forms the same angle with the vertical as does the antenna.—*Jarbuch für drahtlose Tel. und Tel.*, May, 1920.

Books of Technical and Industrial Interest

ARMATURE WINDING AND MOTOR REPAIR. By Daniel H. Braymer. New York: McGraw-Hill Book Company, Inc. 515 pages, 301 illustrations.

Actual detailed methods which have been found practicable in repair shops for winding and reconnecting armatures and for locating and correcting motor troubles have been compiled in this book. As no theoretical or design problems are discussed the work is especially fitted to the needs of the electrical men in industrial plants and of repairmen and armature winders in repair shops. The book is written from the "how-to-do-it" standpoint on the winding of direct-current and alternating-current motors, connection and repair of commutators, adjustment of brushes, operation of starters, location and remedying of motor and generator troubles, and on the machines and tools needed for repair work. Another feature is that the instructions are arranged so that one step follows another in the same order in which the repairman comes to them on the job. An appendix of tables contains information on sizes of wiring for motors, transformers, fuses and different types of drives. A full chapter is devoted to methods of repairing and rebuilding commutators and another to methods used by repairmen to solve special troubles.

VOCABULAIRE EN CINQ LANGUES DE TÉLÉGRAPHIE ET TÉLÉPHONIE SANS FIL. Par Henri Viard. Paris: Gauthier-Villars et Cie.

Here is a little polyglot dictionary which will be of more than ordinary value to translators and to all who are endeavoring to keep abreast of international progress in wireless telegraphy and telephony by recourse to original documents printed in foreign languages. The five tongues from which terms are here collated, with the definitions officially adopted, are the five which among them divide the speech of the great majority of the inhabitants of the Western World—English, French, Italian, Spanish and German. The vocabulary is printed in parallel columns with the English word first, but to make it easy to find a required equivalent for a word, perhaps entirely different, in one of the other four languages an index is included in which the terms other than English are alphabetically arranged and the exact paragraph in which each will be found is indicated. Thus, if a Frenchman should want the official definition or a foreign translation of "vibrateur" or "ronfleur," the Italian of "risonatore," the Spaniard of "zumbador," or the German of "summer," none of them would be likely to hunt under "b," but a glance at the index would show that "buzzer" was in this instance the key word. The definitions of every term are printed in both English and French and great care to assure correctness has been taken. At the end of the book the international and American Morse radio codes are compared. The publishers, rightly we think, predict that the book will have a hearty welcome from specialists who know by experience that if science has no frontiers languages have.

THE BLUE BOOK. The "Electrician" Directory and Handbook of the Electrical Engineering and Allied Trades. London: Benn Brothers, Ltd. 1,445 pages.

The thirty-eighth edition of "The Blue Book," which is the electrical trades directory and handbook published by the London *Electrician*, is thoroughly revised and completely reset. It contains about 100 pages more than the 1919 edition, with the usual arrangement made up in five divisions, as follows: "Handbook," "Alphabetical British Division," "Classified British Division," "Colonial Division" and "Continental Division." In reviewing some of the new features of the handbook the editor comments as follows: "The year 1919 has been a momentous one in the history of the electrical industry, for not only did it witness the successful reconstruction of firms on a peace basis, but it gave birth to the electricity (supply) act, the most important piece of legislation affecting electricity supply since 1882, and to the Ministry of Transport act. The former measure calls into being the electricity commissioners, with extensive powers for the reorganization and development of electricity supply on a national basis, and makes some useful amendments of the electric lighting acts, 1882 to 1909; while the latter act confers wide powers on the Minister of Transport for the organization of the railways and the introduction of electric traction. Already the Electricity Commissioners have started on their important task, and the Minister of Transport has formed a strong committee to report on the most suitable system of electric traction. These measures foreshadow extensive demands for generating plant, rolling stock and equipment from manufacturers and contractors who are already crowded with contracts for extensions of plant postponed owing to the war. The plant on order or decided upon represents over 1,000,000 kw., and many other extensions and new stations are projected. The same happy state of affairs applies to the other branches of the industry—to the manufacturers of electric wires and cables, electric fittings and accessories, wiring contractors, telephone and telegraph engineers, etc."

Books Received

ARTIFICIAL LIGHT. By M. Luckiesh. New York: The Century Company. 366 pages, illustrated.

SERVICE AT COST PLANS. By Harlow C. Clark. New York: American Electric Railway Association. 315 pages.

SPOT AND ARC WELDING. By H. A. Hornor. Philadelphia: J. B. Lippincott Company. 296 pages.

DIRECT-CURRENT MOTOR AND GENERATOR TROUBLES. By Theodore C. Gandy and Elmer C. Schact. New York: McGraw-Hill Book Company, Inc. 274 pages, 109 illustrations.

NINTH ANNUAL REPORT OF THE PUBLIC SERVICE COMMISSION OF WASHINGTON TO THE GOVERNOR. Olympia, Wash.: Frank M. Lamborn, Public Printer.

THE PUBLIC UTILITIES ACT, STATE OF WYOMING. Including all amendments to March 1, 1920. Cheyenne, Wyo.: Public Service Commission of Wyoming.

EXPORTER'S GAZETTEER OF FOREIGN MARKETS. Compiled and edited by Lloyd R. Morris. New York: Johnston Export Publishing Company. 766 pages.

TWELFTH ANNUAL REPORT OF THE HYDRO-ELECTRIC POWER COMMISSION OF THE PROVINCE OF ONTARIO, FOR THE YEAR ENDED OCT. 31, 1919. Vol. I. Toronto: A. T. Wilgress.

ADVOCATES of steam and electrical operation of railroads, men of high professional standing, held a debate at a joint meeting of the A. I. E. E. and the A. S. M. E. in New York City that attracted great attention among engineers. Electrification was shown to be so successful as an operative means that the question resolved itself into one of whether in each case the change would be financially advantageous.

SPEAKING before the Electric Club of Chicago, Dr. Charles P. Steinmetz advocated railroad electrification as a means of saving fuel.

DIFFICULTIES in applying the emergency coal order of the Interstate Commerce Commission are being encountered, and many utilities are asking for a restoration of assigned cars.

OHIO, Oklahoma and Missouri have been added to the number of states in which bureaus for the dissemination of information regarding public utilities have been established.

"LIGHTNING Protection" will be the topic of the A. I. E. E. meeting at Chicago on Nov. 12.

THE GOOD-WILL advertising campaign undertaken by the Public Relations Section of the N. E. L. A. is developing rapidly through the medium of pamphlets and magazine announcements.

LOWER interest rates for the securities of the public utilities are looked for by E. W. Niver of Halsey, Stuart & Company, New York, whose views have been given to the ELECTRICAL WORLD.

UTILITIES of New York City have pooled their coal supplies, amounting to 440,000 tons, to prevent the likelihood of any of them being compelled to shut down.

HEAVY October snows totaling 46 inches have already fallen in the Sierra Mountains, and Pacific Coast hydro-electric stations look for a plentiful supply of water next year.

EXCESS coal cost is taken into consideration by the Pittsfield (Mass.) Electric Company in a lighting schedule to go into effect on Nov. 1.

A PROPOSED reorganization of the American Bureau of Welding is to be discussed at a meeting in New York City on Friday of next week.

A COMPLETE investigation of all the hydro-electric and water-storage possibilities of California is advocated by the Railroad Commission of that state.

NO MATERIAL change from the conditions reported last week is apparent in the electrical market. Stocks are increasing in some places and sales are occasionally made at less than cost, though prices are on the whole maintained. Building stagnation continues and is bound to react on the electrical market. Christmas buying is being deferred by the retailers. Credits are tighter, and collections are still poor. The presidential election, of course, is playing its part in causing slow business, and an improvement after Nov. 2 is anticipated by many.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

CANADA'S government has refused to prohibit the export of electricity as desired by the Ontario Hydro-Electric Power Commission, and the Toronto Power Company will continue to supply 18,000 hp. to the Buffalo General Electric Company.

SPECIAL attention is to be given to water-power matters at the rivers and harbors congress which will be held in Washington Dec. 8, 9 and 10.

THE PROJECT of the Southern California Edison Company on Big Creek in Fresno County, Cal., is being advertised by the Federal Power Commission, in accordance with the water-power act.

FULL jurisdiction over all public utilities, together with their contracts, has been given to the Alabama Public Service Commission by a recent act of the Legislature.

A PERMANENT industrial lighting exhibit, completely installed and operating, is to be set up in San Francisco immediately, and a suitable location for a similar exhibit is being sought in Los Angeles.

BEFORE the international commission now investigating the St. Lawrence waterway and hydro-electric project Henry I. Harriman, president of the New England Power Company, expressed his approval of the plan.

FOUR large issues, totaling nearly $50,000,000, mark a high record in weekly financing for electrical companies. Of this amount the Westinghouse company offers $30,000,000 in ten-year 7 per cent bonds.

ELECTRICAL credit men are reported to be optimistic despite decreasing demand and slow collections. The depression is thought to be only temporary, and a period of great prosperity is looked for in a few months.

CANCELLATION of orders and other prevailing conditions were discussed at the section meetings of the Associated Manufacturers of Electrical Supplies.

ADOPTION of a uniform method of procedure on rates throughout the state is being advocated by the committee on electric service rates of the Iowa Section, N. E. L. A.

PRACTICAL instruction will be enlarged at the Massachusetts Institute of Technology by opening commercial departments as well as shops of the General Electric Company to students taking co-operative educational courses.

THE RIGHT of the Androscoggin Electric Company to sell electrical energy in the town of Leeds has been affirmed by the Maine Public Utilities Commission against the protest of the Monmouth Electric Company and the Turners Falls Power Company, operating in adjacent territory.

AN ANNUAL loss of $300,000,000 arises from accidents due to defective lighting, according to an insurance expert speaking before safety and lighting engineers.

THE FACT that the average rise in prices of electrical equipment has been much less than in most other lines of industry and the further fact that many manufacturers are working on high-priced materials bought under contract several months ago are proving embarrassing to the electrical trade in connection with the prevailing effort of the public to force down the prices of all commodities.

DECREASE in costs of raw materials, especially copper and cotton, and the cutting out to a large degree of overtime work in factories, while their tendency is to bring lower prices for finished electrical products, will not, owing to various circumstances, have a marked effect in this direction at the present time.

MANUFACTURERS of Christmas tree lighting outfits report that they are unable to fill the demand.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Cancellation of Orders Slows Down Factory Outputs

CANCELLATION of orders which has resulted in a marked slowing down in the output of some factories was the subject of considerable discussion at the section meetings of the Associated Manufacturers of Electrical Supplies held in New York from Oct. 18 to 27. Although many cancellations have been made on account of delayed deliveries, there have been numerous cancellations for various other reasons, and the total has been sufficient to cause some manufacturers to curtail the number of employees. One New England firm has decided to decrease its force by 10 per cent and at the same time lengthen the working day from nine to ten hours without increasing wages. This was necessary in order to keep the plant in operation on a profitable basis.

Those manufacturers who have decreased the number of employees announce that there has been a marked increase in efficiency in their plants, and it was the consensus of opinion that lower manufacturing costs and lower prices are bound to follow. It is expected that prices for electrical supplies will reach an appreciably lower level within the next six months, at which point they will probably remain stabilized.

Difficulties Met With in Applying Emergency Coal Order

DESPITE the softening of coal prices, numerous requests have come to the National Committee on Gas and Electric Service for assistance in one form or another from utilities that are nervous about their coal supply, but in most cases the requests are for a continuance of the assigned-car privilege. It does not seem to be generally understood that under the new public utilities service order assigned cars are to be given only when it has been proved positively that coal cannot otherwise be obtained.

George W. Elliott, the secretary of the National Committee on Gas and Electric Service, points out that his committee, which is working in co-operation with the Interstate Commerce Commission, can look after the distribution of coal only. It has developed in numerous cases that the utility has no contract for coal. If the utility is not protected by a contract, it is difficult for the committee to be of service, although in some cases relief has been given under those conditions through the help extended by the National Coal Association. Wherever it has been established that an emergency exists the coal was obtained through arrangement with the contracting operator.

There has been some difficulty, Mr. Elliott said, in determining just what constitutes an emergency. In some cases four days' supply of coal is regarded as the minimum amount which can be allowed as a margin of safety. In fact, each case, he said, must be considered separately, since so much depends on the probability of securing coal quickly.

Almost $50,000,000 New Electrical Financing This Week

FOUR large issues, totaling $48,375,000 in the last six days, marked a high record in weekly electrical financing. The largest issue was $30,000,000 in ten-year 7 per cent gold bonds of the Westinghouse Electric & Manufacturing Company, offered at 94¾, to net 7¾ per cent. The other three issues were by light and power companies. The Pennsylvania-Ohio Power & Light Company has sold $13,000,000 of twenty-year first and refunding mortgage 7½ per cent bonds at 96½, to yield 7.85 per cent. The other two issues are smaller, as follows: $2,750,000 Conemaugh Power Company first mortgage ten-year 8 per cent bonds at 99, to yield about 8.15 per cent, and $2,625,000 San Joaquin Light & Power Corporation 8 per cent convertible collateral trust bonds, due Nov. 1, 1935, at par.

Electrification Now Merely a Question of Whether It Will Pay

WITH facts on which to base their contentions, proponents of electrical and of steam operation of railroads made it clear last week at one of the most interesting meetings ever devoted to this subject that electrification will come only as a result of individual roads being convinced that the return secured will warrant the expenditure involved. This subject was debated before a joint meeting of the New York sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers and the railroad section of the A. S. M. E., with its chairman, E. B. Katte, presiding in conjunction with H. W. Buck and W. S. Finlay, Jr. Each side was represented by manufacturers and operators, who were well qualified to bring out the essential facts. Keen interest was evinced by those in attendance, who filled the hall and all available standing room. On the platform and in the audience were many "old-timers" prominent in the early discussions of electrification problems.

Among the most ardent advocates of railroad electrification who took part in the discussion were Frank J. Sprague, called the "father of electric traction"; A. H. Armstrong,* chairman of the electrification committee of the General Electric Company; F. H. Shepard, director of heavy traction for the Westinghouse Electric & Manufacturing Company; C. H. Quinn, chief electrical engineer of the Norfolk & Western Railway Company; A. L. Ralston, mechanical superintendent of the New

*See data on page 878.

York, New Haven & Hartford Railroad; R. Beeuwkes, electrical engineer of the Chicago, Milwaukee & St. Paul Railway, and E. B. Katté, chief engineer electric traction for the New York Central Railroad. Advantages of the steam locomotive were presented by John E. Muhlfeld, vice-president Railway & Industrial Engineers, Inc.; F. J. Cole, American Locomotive Company; A. W. Gibbs, chief mechanical engineer of the Pennsylvania System; W. L. Bean, assistant general mechanical superintendent of the New York, New Haven & Hartford Railroad; F. H. Hardin, chief engineer of motive power New York Central Railroad, and William F. Kiesel, Jr., mechanical engineer Pennsylvania Railroad.

It was admitted even by the champions of steam locomotives that the electrical system is more economical of fuels, involves lower maintenance expense and handles a greater volume of traffic, but the question of whether it will pay to electrify roads already equipped for steam proved to be a bone of contention. Mr. Muhlfeld contended that a large investment must be scrapped in electrifying a steam system and that past comparisons have not taken into consideration the economy of the most modern steam locomotives. The necessity of more financial data was also expressed by Mr. Cole, who contended that all expenses incidental to electric operation and not merely those connected with locomotion must be charged against electrification. Although the advantages of electrifying the Chicago, Milwaukee & St. Paul Railway, the Norfolk & Western, the New York Central and the Baltimore terminal were recognized by Mr. Gibbs, he said they were due chiefly to the mountains, tunnels, etc., which were encountered and that double-tracking is an alternative which should be considered in most cases. He also brought out the point that if branch lines are not electrified with the trunk lines, steam locomotives and the necessary adjuncts such as intermediate terminals will have to be maintained anyway. The greater cost of electric locomotives as compared with steam locomotives was emphasized by Messrs. Brown and Bean, and the former contended that the coal consumption of modern steam locomotives is 28 to 30 per cent less than the figures given in Mr. Armstrong's paper. (See page 878.)

The cause of the electrification was fairly and ably defended with facts and actual performance data. Mr. Sprague said that his firm belief in the coming supremacy of the electric locomotive is based on the increased traffic capacity of roads which have been electrified. This point was supported by Mr. Shepard, who said that "it is entirely practicable to build an electric locomotive to take any train which will hold together over any profile and at any desired speed."

The opinions of the operating men were particularly convincing. Mr. Quinn said that the Norfolk & Western Railroad had failed to find a steam locomotive to meet its needs, whereas electric locomotives do. The large steam units employed have to move on restricted sections owing to excessive weight and the extra clearance required, but it is not so with the electric locomotive. Comparison of the two systems shows a 25 per cent fuel saving and 100 per cent more tonnage with electric locomotives.

Although electric locomotives were attacked as being constant-speed machines, Mr. Ralston said that he considered them to have sufficiently flexible speed. On the New Haven road they have been hauling 10 to 30 per cent more than rated capacity and saved $755,000 in fuel alone during 1919.

Dr. Steinmetz Advocates Railway Electrification

RAILWAY electrification as a means of solving the coal shortage and the increasing freight congestion was advocated by Dr. Charles P. Steinmetz in an address before the Electric Club at the Morrison Hotel in Chicago on Oct. 21. Dr. Steinmetz pointed out that the railroads use the largest amount of coal that any single industry in the country requires. Any equipment required for railway fuel distribution that can be released for other uses is equivalent to an increase. The electrification of the steam railways will accomplish this in two ways. One is by reducing the total quantity of fuel required for railway use, this saving being estimated by Dr. Steinmetz from statistics gathered from former coal-burning roads at 66 per cent. The other is the release of the large amount of equipment required to deliver fuel to a few in place of the many coaling stations now required.

N. E. L. A. Good-Will Advertising Program Developing Rapidly

THE good-will campaign undertaken by the Public Relations Section of the National Electric Light Association is developing very rapidly. All the pamphlets thus far prepared are selling in enormous quantities.

Brief messages to security holders and prospective security holders of electric light and power companies have been prepared in the shape of four pamphlets with attractive covers. These pamphlets are the result of many conferences between the public service securities committee of the Investment Bankers' Association of America and representatives of the executive committee of the Public Relations Section of the N. E. L. A. The pamphlets bear upon the back cover a copy of a resolution adopted by the Investment Bankers' Association.

P. L. Thomson, chairman of the manufacturers' advertising committee of the Public Relations Section, reports that the campaign for popular-magazine advertising over the names of individual manufacturers but in behalf of the electric light and power industry should be under way within the next few weeks.

Ohio, Oklahoma and Missouri Now Have Utility Information Bureaus

ANNOUNCEMENT is made of the completion of three new state committees on public utility information in Ohio, Oklahoma and Missouri. These committees represent all utility interests of the state and are organized for the purpose of disseminating unbiased information through newspapers, bulletins, speakers and otherwise, so that the public may be fully advised regarding the problems of the utilities and the public's own interest in efficient utility service. A committee is just being completed in Arkansas, with A. G. Whidden of Pine Bluff as director.

The Ohio committee has established headquarters at 901 Illuminating Building, Cleveland, Ohio, with Benjamin E. Ling, an ex-newspaper man, as director. The Oklahoma committee will be conducted under the auspices of the Oklahoma Utilities Association, with H. A. Lane, secretary of that association, as director. The Missouri committee will be conducted under the direction of the Missouri Association of Public Utilities, with headquarters at 3725 North Broadway, St. Louis.

A. I. E. E. to Discuss Lightning Protection at Chicago Meeting

ON FRIDAY, Nov. 12, the American Institute of Electrical Engineers will hold its three hundred and sixty-fifth meeting under the joint auspices of the Chicago Section and the protective devices committee. The electrical section of the Western Society of Engineers will participate. The following program will be carried out:

3 p.m.—Board of directors' meeting, Western Society of Engineers' Rooms, 1735 Monadnock Block.

5:15 p.m.—Informal reception, City Club, 315 Plymouth Court.

5:45 p.m.—Dinner, City Club.

7:30 p.m.—Technical session, City Club: "Lightning-Arrester Spark Gaps—II," by C. T. Allcutt of the Westinghouse Electric & Manufacturing Company; "Life of Performance Tests of Oxide-Film Lightning Arresters," by N. A. Lougee of the General Electric Company; "Studies in Lightning Protection on 4,000-Volt Circuits—II," by D. W. Roper of the Commonwealth Edison Company; "Electrostatic Condensers," by V. E. Goodwin of the General Electric Company.

Canada Refuses to Prohibit Power Exports Because of Situation in Ontario

THE power situation in Ontario, particularly in Toronto, Hamilton, London, Windsor and other cities and towns served by the Hydro-Electric Power Commission, has become very acute owing to the cutting off on Oct. 15 by the Toronto Power Company of a supply of 15,000 hp. which it had been previously furnishing to the commission under a contract with the Ontario Power Company.

A conference was held at the offices of the provincial Hydro-Electric Commission in Toronto on Oct. 22 between Sir Adam Beck, chairman of the commission, and R. J. Fleming, general manager of the Toronto Power Company. The commission had previously appealed to the Dominion government for intervention with a view to having the government place an embargo upon the exportation of power to Buffalo by the Toronto Power Company. Sir George Foster, acting federal Premier, replied that the government could not take any action under the electricity and fluids exportation act of 1907. The reason given was that an embargo would arouse anti-Canadian sentiment in Buffalo.

The contract with the Ontario Power Company under which the Toronto Power Company is now exporting 18,000 hp. to the Buffalo General Electric Company expired on Oct. 20. The Hydro-Electric Power Commission endeavored to purchase this power and offered $20 per horsepower. Mr. Fleming at the conference on Oct. 22 said that the contract with the Buffalo General Electric Company had been renewed. The Hydro officers offered terms on a two-year contract, while the Buffalo company offered to buy on a long-term basis.

Sir Adam Beck stated that Canada, under the terms of the treaty existing between the United States and the Dominion, is entitled to approximately 600,000 hp. from the water available at Niagara but is receiving only 325,000 hp. The United States, he said, is deriving 510,000 hp., while the treaty provides that Canada shall receive power in the ratio of 36 against 20 for the United States. According to Sir Adam, 43,000 hp., consisting of the 18,000 hp. now going to the Buffalo General Electric Company and an additional 25,000 hp. which could be developed by the Toronto Power Company, if made available for the Hydro-Electric Power Commission, would put that body out of difficulty over the winter of 1920-21. Sir Adam asked Mr. Fleming if the Toronto Power Company were disposed to supply this 25,000 hp. to the Toronto Hydro Power Commission under the judgment of the commission at $9 per horsepower, but Mr. Fleming declined to consider the proposition, for engineering and other reasons.

California Commission Links the State's Prosperity with Hydro-Electricity

REFERRING to the estimate of experts that it will require between three-quarters of a billion and a billion dollars to construct the necessary hydro-electric plants to care for future demands for power in California, the Railroad Commission of that state, in a letter to the Governor transmitting its annual report, declared this week that while no estimate has been made of the probable necessary expenditures to carry out a program for the conservation of water for irrigation and domestic uses, the required amount will undoubtedly equal that estimated for electrical development.

Any halt in the state's hydro-electric development will spell disaster, the commission asserts, and it further declares that the state's paramount need is cheap power.

It is the commission's firm belief that financially sound utilities, functioning economically and efficiently, will successfully carry the burden of California's development. It is obvious, it says, that industrial and agricultural California cannot reach the peak of development unless there stride, a step in advance, utilities carrying service possibilities "ready on demand." Such a service can be accomplished only through the fair distribution of the costs and fair treatment of utility consumer, utility owner and utility labor. In this connection the commission declares its belief that utilities are today, as the result of regulation, selling their product at a price nearer that of pre-war days than the price of any other commodity.

Insurance Companies Are Placing More Emphasis on Electrical Inspection

STRICTER adherence to the clause in fire insurance policies which provides that policy holders must have in their possession certificates of inspection covering the electrical equipment installed is being required by the insurance companies. So far this year a number of cases have come up in New York City, involving a loss of as much as $30,000 in a single instance, on which the insurance company has made compromise settlements on the basis of 50 cents on the dollar because the holder of the policy did not have the proper inspection certificate. In all of the cases it was claimed that the fire was of electrical origin. Up to the first of this year insurance companies had for the most part accepted and paid losses even though unapproved equipment was installed or the inspection certificate was lacking.

By withholding payments on losses where the inspection requirements have not been met the insurance companies hope to sound a warning to policy holders who are delinquent in this respect. Enforcement of this clause in the policies will result in the owners either making their electrical equipment conform to the underwriters' requirements or paying an increased rate.

Heavy October Snows Assure Next Year's Power for California

ACCORDING to Weather Bureau statistics more snow has fallen in the Sierra Mountains this month than in any October since 1878, with the exception of the year 1899. As early-season snow is of much more value than snow which falls late in the season, there is every reason for power companies throughout the Pacific Coast States to be optimistic concerning their supply of water for next year. Rainfall in good volume is reported generally among the Coast states in October. While 89 inches of snow fell at Summit, Cal., twenty-one years ago, 46 inches has fallen in the first two-thirds of the month of October, 1920. The mean snowfall for October is given at 13.6 inches.

Alabama Commission Now Possesses Jurisdiction Over All Contracts

A RECENT act of the Alabama State Legislature increases the powers of the Alabama Public Service Commission by giving it full jurisdiction over all public utilities together with their contracts. By this new law the commission now has authority to fix rates regardless of franchises or contracts held by individuals and municipalities or utilities and individuals whether made before or after the act.

A. S. M. E. to Discuss Fuels, Power Supply and Motor-Driven Sawmills

MEETING in New York City on Dec. 7 to 10 in annual convention, the American Society of Mechanical Engineers will, in the course of its program, deal with a number of topics of interest to electrical engineers and central-station management. At a session on fuels the following papers will be presented: "The Fuel Supply of the World," by L. P. Breckenridge; "The Low-Temperature Distillation of Coal," by O. P. Hood; "Fuel Conservation Versus Money Conservation," by D. M. Myers, and "Form Value of Energy in Relation to Its Production, Transportation and Application," by Chester G. Gilbert and Joseph E. Pogue.

There will also be a session devoted to consideration of the future development of power. "Electrically Operated Sawmills" will be discussed by A. E. Hall, and "The Constitution and Properties of Boiler Tubes" will be the subject of a paper by A. E. White.

Uniform Method of Procedure on Rates Advocated for Iowa

ACTIVITY of the committee on electric service rates of the Iowa Section of the National Electric Light Association began with a meeting at Cedar Rapids, Iowa, on Oct. 18, when the subject of rate increases was discussed exhaustively and many differences of opinion were expressed. However, it was agreed that a uniform rate throughout the state was an impossibility because of varying conditions, and that therefore a uniform method of procedure was the sane end toward which to work.

There was prepared for presentation to the executive council a statement recommending the necessity for immediate concerted action on the part of the electric utilities of the state toward obtaining rate readjustments on the basis of investment in property used and useful in supplying electric service, basing the rate of return on the prevailing costs of money, plus a profit, above all the costs of operation, including taxes and insurance, the cost of money, the continuous maintenance of property and the amounts required for amortization and contingencies, and including in rate schedules in addition a fuel differentiation.

The opinion was also unanimously expressed that more publicity on the various rate increases in the state would noticeably ease the situation in other towns, and an effort will be made to inform the general public of all rate readjustments throughout the state.

Coal Cost to Affect Lighting Bills

A RATE will be applied to electric lighting bills after Nov. 1 by the Pittsfield (Mass.) Electric Company which will take excess coal cost into consideration. In a recent statement to customers the company pointed out that the charges for electric lighting service have increased very slightly since 1913. The maximum rate, 12 cents per kilowatt-hour, remains the same. Since 1916 the cost of coal has increased to the company from $4 to $11, or 175 per cent. Labor has increased 75 per cent, and the cost of money borrowed to build lines and to purchase power-plant equipment has increased 60 per cent. By careful operation the company has been able to meet part of the increase in expenses, but the rapid increase in the cost of coal during the past few months makes it now necessary to increase the charges for electric lighting during the months in which the high price of coal prevails.

To the present schedule of lighting rates will be added after Nov. 1 an "excess-coal-cost rate," to be determined monthly by the cost of coal during the preceding month. This rate will be 0.15 cent per kilowatt-hour for each $1 increase in the cost of coal per net ton in the plant of the company above $4. Should the cost of coal drop below $4, a corresponding reduction will be made. Reduction in the cost of labor or in interest rates on borrowed money will also cause a prompt reduction in charges for lighting service.

Defective Lighting Said to Cause Annual Accident Loss of $300,000,000

OUT of an annual economic waste of $2,000,000,000 caused by accidents, R. E. Simpson, safety engineer of the Travelers' Insurance Company, stated at the joint meeting on Oct. 22 of the American Society of Safety Engineers and the New York Section of the Illuminating Engineering Society, it is a conservative conclusion that 15 per cent is due to defective illumination, or a total economic loss of $300,000,000 yearly to the country. This amount exceeds the total annual cost of illumination.

By defective illumination is meant any violation of the principles of good lighting. This is nowhere more evident than in the neglect of such details as the illumination of stairways, passageways and storage space, where as a result there are very many fatal falls.

In view of the direct bearing which lighting equipment has on safety conditions, the importance of keeping the equipment in first-class operating condition and the responsibility in this regard of the man who is maintaining the apparatus were emphasized by A. J. Thompson in his discussion on disconnecting hangers. H. F. J. Porter, consulting engineer of the Society for

Electrical Development, called attention to the relation between sharpness of vision and reduction of accidents, saying that the employer should feel obligated to see that his employees, if their sight is defective, shall have an opportunity to be fitted with the proper glasses.

It is not possible at the present time to define good industrial lighting, S. E. Doane, National Lamp Works, remarked. The view of what constitutes good illumination has changed, and while 15 or 24 foot-candles might now be considered excellent practice for certain industries, it is not entirely improbable that twice these values will be considered the best intensities in the near future. S. G. Hibben, Westinghouse Lamp Company, showed the definite relation of maintenance of lighting equipment to safety arising from the depreciation of illumination through accumulation of dirt on fixtures.

Proposed Reorganization of American Bureau of Welding

A PLAN for the reorganization of the American Bureau of Welding, proposed by Prof. C. A. Adams, director of the bureau, will be discussed at a meeting of the bureau on Nov. 22 at 33 West Thirty-ninth Street, New York City. This plan is briefly that the bureau be organized as the general welding research advisory committee of the American Welding Society and also of the engineering division National Research Council.

The new scheme was explained by Professor Adams before the American Welding Society on Oct. 25 and was heartily indorsed by several of the older members. A tentative program offered at that meeting was partly as follows:

1. Standardize welding procedure, in so far as possible, for each process and for each application.
2. Compile data as to strength, ductility, cost, etc., of welds made by the various methods.
3. Develop a standard training course.
4. Collect impartial data, based on tests, on efficiencies, pounds of metal deposited per hour and per kilowatt-hour, power factor, etc., and data on spot, electro-percussive and automatic arc welding, etc.
5. Compile impartial information on materials, such as fluxes, electrodes and welding rods.
6. Standardize methods for inspecting and testing welds.
7. Make sets of sample fractured welded test specimens of specific materials made by standard procedure, which will be furnished to those interested upon payment of a proper fee.
8. Revise and standardize welding nomenclature.

Harriman Favors St. Lawrence Power Development

HENRY I. HARRIMAN, president of the New England Power Company, Boston, advocated the development of the St. Lawrence waterway and power resources at a hearing Oct. 18 in Boston before the international commission charged with investigating the project. He said that in 113 miles the St. Lawrence falls 91 ft. (28 m.) and that in the 70 miles (112 km.) of rapids above Montreal it falls 230 ft. (70 m.) more. The mean flow is 241,000 ft. (6,750 m.) per second, giving a continuous capacity of 4,000,000 hp. of electrical energy. The Great Lakes act as a reservoir in equalizing this flow within 25 per cent of the mean.

The possible output from this development, it was pointed out, would be 24,000,000,000 kw.-hr. a year, equivalent to the energy of 24,000,000 tons of coal burned in the most modern steam plants. All the public utilities of the state of New York and of New England combined, he stated, produce less than 5,400,000,000 kw.-hr. yearly, or about one-fourth the annual output of these great water powers. If the United States pays half the cost of the St. Lawrence development, the speaker said, it should be entitled to not merely one-quarter of the power which will be developed on the American side of the border but one-half the total power. If the upper estimate of $250,000,000 is accepted as the probable cost, one-tenth of a cent per kilowatt-hour set aside for interest payments and sinking fund requirements will, when the power is sold, pay the entire interest charge and set up a sinking fund that will retire the entire capital expense in thirty-five years.

Ontario Hydro-Electric Commission Favors St. Lawrence Plan

AT A MEETING of the International Joint Commission for the deepening of the St. Lawrence River held at Kingston, Ontario, on Oct. 11, Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, presented a preliminary report of the survey made by the commission of the St. Lawrence River from Kingston to Montreal. The report pointed out that in all consideration of the work navigation and power could not be separated. They were so intimately connected that one could not be sacrificed to the advantage of the other. It was estimated that power equivalent to the extent of 20,000,000 tons of coal per year could be developed, which was more than the entire importation of coal into Canada per year.

Industrial Lighting Exhibit to Open in San Francisco

THE industrial lighting exhibit committee of the California Electrical Co-operative Campaign has completed all the preliminary arrangements and expects to have a permanent industrial lighting exhibit completely installed and operating in San Francisco by Nov. 1. The exhibit in Los Angeles has been delayed owing to difficulty in finding a suitable location. These exhibits follow a similar and successful lighting exhibit at the Pasadena convention of the National Electric Light Association this year.

Electrical Christmas Campaign

THE Society for Electrical Development has just mailed to the industry, both members and non-members, copies of the Christmas campaign issue of its monthly sales service with complete plans and descriptions of all the material and advertising cuts available for the campaign. The advertising program is cleverly built around Santa Claus, with a man and a woman, as shown herewith, whispering in his ear to say "Merry Christmas electrically." The society is trying to broaden this campaign to include the entire industry, non-members of the society as well as members, and is ready to do all in its power to promote buying of electrical gifts.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Progress at Binghamton, N. Y.—The month of September was the largest month in kilowatt-hour output and kilowatt demand in the history of the Binghamton Light, Heat & Power Company, the gross output being 2,186,620 kw.-hr., which is an increase of 9½ per cent over August, 1920, and of 50 per cent over September, 1919.

Pole Lines in New Jersey.—The New Jersey State Highway Commission has decided that electric companies may erect pole lines along state roads at places designated by the state highway engineer, but that the companies must paint all poles white to a height of 6 ft. from the ground so that they may act as a danger signal at night to motorists and others.

A Giant Electric Sign.—One of the largest electric signs in the United States is being installed on the roof of the new plant of the Berkshire Knitting Mills at Wyomissing, Pa. The sign will be 365 ft. long and 21 ft. high and will require about 4,500 10-watt lamps. The letters of the display, "Berkshire Knitting Mills—Hosiery as You Like It," will be 10 ft. high.

Nebraska Company Boosts Own Rates.—The Central Power Company of Kearney, Neb., having failed to induce the city commissioners to authorize a 20 per cent increase in rates on electricity, took the initiative by announcing the new rate effective, retroactive from Sept. 1. The Railroad Commission, it is asserted, refused to act; the city commission contended it was powerless to alter rates, and litigation through the Supreme Court would have involved too much delay. The company therefore decided to put the rate into force and await results.

Disposing of Excess Energy from Kerckhoff Project.—Completion by the San Joaquin Light & Power Corporation of the Kerckhoff power plant and of steam plants at Bakersfield and Midway having made available electrical energy beyond its needs, the Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to enter into an agreement with the San Joaquin company under which the excess energy may be delivered to the Pacific system. The commission is asked to approve a plan by which the Pacific company will advance to the San Joaquin company sufficient funds to construct an electric transmission line from the Kerckhoff plant to its electric substation in Merced City. The delivery to the Pacific company is to be made in the city of Newman. The commission is also asked to fix the amount to be paid for the excess energy by the Pacific company.

Standing Committee on Rural Service.—A sign of the times is the reported decision of the executive committee of the Ohio Electric Light Association to appoint a new standing committee on rural service. "There is so much to be learned about this class of business," says the association's monthly bulletin, "and so many angles to its make-up that this committee will have plenty to do for a time at least."

Damming the Chattahoochee.—To replace rock-crib-fill dams near Riverview, Ala., on the Chattahoochee River, which were washed away in last winter's floods, a stone structure 900 ft. long is being built from the Georgia shore to Campbell Island which with a dam now connecting that island with the Alabama side will make a continuous barrier across the river, thus insuring uninterrupted hydro-electric power in that region.

Rutland Company Employees and Consumers Buy Stock.—The Rutland (Vt.) Railway, Light & Power Company has begun selling its 7 per cent cumulative preferred stock to consumers and employees, this being the first time that an opportunity to acquire stock has been given them. To dispose of this stock about 125 employees are organized into teams, each team being headed by a captain, and prizes are offered for the best records. Success seems assured, ninety-six shares having been sold for cash and ninety-eight shares on the installment plan in the first week.

Electrical Development in India.—In a paper recently read before an engineering congress in Lahore, India, the writer estimated the total electrical installations in India as being only 0.742 watt per head of population, which compared with 33 watts in the British Isles, 56.9 in South Africa, 61.8 in Australia and 148 in Canada. India, the author said, has not the same incentive to exploit the water power available because her industry is in the main agricultural, labor is low-priced and the native population have few wants. Two large projects are, however, under consideration—a 60,000-kw. development on the Sutlej and a 10,000-kw. development on the Ravi River. Of these the former is the more economical. Nationalization of the water powers of India was favored in the paper as the best means to insure development.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Montreal Electrical Club.—The Montreal Weekly Electrical Luncheon has changed its name to the Montreal Electrical Club. W. H. Winter has been elected president and T. H. Chennel secretary-treasurer.

Jovian Order.—The date of the annual convention of the Jovian Order, to be held at the American Hotel Annex, St. Louis, has been changed to Nov. 25 and 26, so as not to conflict with the dates selected by any other organization.

American Welding Society.—"The United States Navy's Arc-Weld Battle Towing Target No. 60" was described by James W. Ovens of the Norfolk (Va.) Navy Yard at a meeting of this society in New York on Oct. 25.

Radio Club of America.—This club met at Columbia University, New York, on Oct. 22 to listen to a paper by Julius G. Aceves, assistant research engineer to Prof. M. I. Pupin, on "Determination of Resistance, Inductance and Capacity by the Wheatstone Bridge Method."

Philadelphia Section, A. I. E. E.—Officers of this section for 1920-21 are as follows: Chairman, C. E. Bonine; secretary and treasurer, R. B. Mateer; assistant secretary, Raymond Bailey; managers, P. H. Chase, E. B. Tuttle, C. W. Fisher, B. Reynolds and L. J. Costa.

Association of Iron and Steel Electrical Engineers.—The Philadelphia Section of this association is to meet on Saturday, Nov. 6, when "Electric Heat Treatment—Present Practices and Future Possibilities," will be discussed by George P. Mills, Electric Furnace Construction Company, Philadelphia; J. R. Bower, American Car & Foundry Company, Berwick, Pa., and James E. Wilson, Treadwell Engineering Company, Easton, Pa. On Monday, Nov. 8, the Cleveland District Section will discuss a paper by Gordon Gage, chief electrician American Rolling Mill Company, Middletown, Ohio, on "Slip Regenerators Versus Notchbacks."

Coming Meetings of Electrical and Other Technical Societies

Institute of Radio Engineers—New York, Nov. 3.

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Nov. 6; Cleveland Section, Nov. 8.

National Association of Railway and Public Utilities Commissioners—Washington, Nov. 9.

Society of Naval Architects and Marine Engineers—New York, Nov. 11-12.

American Institute of Electrical Engineers—Chicago Section, Nov. 12.

Electric Power Club—Hot Springs, Va., Nov. 15-18.

Florida Ice and Public Utilities Association—Miami, Fla., Nov. 15 and 16.

National Electric Light Association—Southeastern Geographic Division, Miami, Fla., Nov. 17-19. (For program see issue of Oct. 23, page 845.)

Electrical Supply Jobbers' Association—Cleveland, Nov. 17-19.

American Engineering Council—Washington, Nov. 18-20. (For program see issue of Sept. 25, page 651.)

Jovian Order—St. Louis, Nov. 25 and 26.

American Physical Society—Cleveland, Nov. 27; annual meeting Chicago, Dec. 28-Jan. 1.

American Society of Mechanical Engineers—New York, Dec. 7-10.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Character of Service—Inefficiency.—The customers of an electric company should not be compelled to pay for the operation of an inefficient, obsolete and worn-out plant, the New York Public Service Commission for the Second District has asserted. Figures which show an increase in the unit cost of production of electricity of 68.9 per cent for the year 1918 over 1917, and of more than 61 per cent for 1918 over 1916, show a steady deterioration in the efficiency of the plant or in the business management.

Means of Arriving at Just Returns Where Several Municipalities Are Served.—Just and reasonable rates for electric utility service within a municipality wherein the plant is situated and from which nearby municipalities are supplied by transmission line are ascertained, according to the Missouri Public Service Commission, by considering the system as a unit, after eliminating the expense and return due to the transmission line, and then assigning the greater portion of the burden of the transmission line to the communities served thereby.

Coal Clause Authorized in Indiana.—Authority to vary electric power charges fifteen-hundredths of a cent a kilowatt-hour for each 5 cents up or down from an average monthly coal cost of $3.70 a ton is contained in an order the Indiana Public Service Commission has issued applicable to the Muncie district, served by the Indiana General Service Company. The commission authorized the company to increase the last two steps in its secondary power rates so as to produce about $2,000 more revenue a month. Only one or two large companies are affected by the specific increase, it is said in the order.

Pacific Power & Light Rate Increases Granted.—The Public Service Commission of Washington on Sept. 29 handed down a decision in the case of the Pacific Power & Light Company, Portland, Ore., concerning applications for rate increases made in March on all cities and towns served by the company in Washington, involving gross annual increases of $240,000. All the company's requests were granted, with substantial modifications, however, in the cities of Yakima, Walla Walla, Pomeroy and Toppenish, where the increase asked was held to be excessive. The increases cover domestic and commercial metered lighting, flat commercial lighting and commercial and flour-milling power. No change was asked for in cooking or irrigation power.

Special Rates Given to City by Franchise Invalid.—The Public Utilities Commission of Idaho, in passing upon the application of the Utah Power & Light Company for authority to apply a regular schedule for emergency service to the city of Idaho Falls in connection with the operation of its municipal plant—the city on its part claiming the privilege of a special rate by the terms of a franchise granted by it to the power company in 1907 and running twenty years—has declared that no municipality can delegate by franchise authority not vested in it by the state nor claim privileges as a customer not in accordance with the rates and rules and regulations fixed by statute covering commission regulation. "Our attention has not been called," says the commission's order, "to any provision of the public utilities law which authorizes or justifies the public utilities corporation applicant herein to make any charges to the city of Idaho Falls for service rendered other or different than those specified in its schedules on file and in effect at that time. It is therefore ordered that the petition be granted and that applicant be required to apply such rates for service as are named in schedules on file at the time the service is given."

Vermont Commission on Principles of Valuation.—In finding unfounded a complaint that the power rates of the Montpelier & Barre Light & Power Company were unreasonable, the Vermont Public Service Commission made the following among other observations upon the principles underlying valuation: (1) The fair present-day value is the proper basis for rate making. (2) Original cost taken alone is not a proper basis for determining present-day values, but is entitled to consideration. (3) It is not just to fix values upon present-day prices if these are abnormally high or low. (4) A valuation based upon average prices for ten years including the war period ought to produce as fair results as it is possible to obtain. (5) A flat estimate of $20 per horsepower as applied to different water powers of a hydro-electric company could not be approved where in fixing such value no consideration was given to the probable cost of development and this cost would vary. (6) In determining the cost of reproduction new there should be added to the sum obtained by estimating the actual cost of the several units of which the property is composed a sum to represent the overhead expenses incidental to the construction of the plant as a whole and not assignable to any particular unit. (7) The accrued deficit of a utility from the time it came into the hands of the present owners could not be allowed as going value since such a method would guarantee the utility against all losses. (8) Reproduction cost new should be reduced by a sum which would leave that figure fairly representative of the value of the properties as they in fact exist at the time of valuation.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Jury Entitled to Know that Witnesses in Damage Suit Represent Insurance Company.—In an action for the death of a servant, while it would have been an error to disclose to the jury the fact that an insurance company was bound by contract to indemnify the defendant, the Supreme Court of Missouri observed in Snyder vs. Wagner Electric Manufacturing Company, yet if the insurance company chose to produce its own witnesses, the jury was entitled to know whom they represented and to have their interest in the case disclosed. (223 S. W. 911.)*

Missouri Commission Law.—The Supreme Court of Missouri has held, in State ex rel. Case, that the statute providing that writs to review orders of the Public Service Commission may be sued out of the circuit court of the county where the hearing was held or in which the commission has its principal office is not void under the constitution, the condition th. jurisdiction shall depend on a hearing having been held being a reasonable one and the presumption being that the commission in fixing a place for hearing will exercise sound discretion and consider the convenience of the parties and witnesses. Where the commission held a hearing on a rate case first in one county and afterward in another county, the Circuit Court of the latter county had jurisdiction to review the commission's order. (223 S. W. 664.)

Assumption of Risk by Lineman Question for Jury.—In Clark vs. Kansas City Light & Power Company, a verdict against the company for the death of a lineman through contact with improperly insulated 2,300-volt wires was reversed by the Kansas City Court of Appeals and the cause remanded to the inferior court because of inadmissible and prejudicial testimony to the effect that it was customary to send another man up a pole with a lineman to help him, which in this case had not been done. The court found, however, that as a matter of law the man could not be held negligent if he failed to observe that the insulation was in bad condition and that as a matter of law he did not assume the risk when on his foreman's order he ascended the pole, these being questions for the jury. An instruction that it was defendant's duty to exercise the utmost care to keep its high-tension wires adequately protected was not erroneous. (223 S. W. 984.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

L. M. Klauber, who has recently been promoted to be general superintendent of the San Diego (Cal.) Consolidated Gas & Electric Company, of which he was previously assistant general superintendent, has been with that company since 1911. He was born in San Diego in 1883 and was graduated from Stanford University in the department of electrical engineering. From 1908 to 1910 he spent in the Westinghouse Electric & Manufacturing Company's graduate apprentice school at East Pittsburgh, Pa. His first position with the San Diego company was that of new-business solicitor, after which he served as engineer in charge of record department, superintendent of electric department and assistant general superintendent. Mr. Klauber has been a frequent contributor to the technical press, writing mainly on problems of transmission and distribution. He has also a number of inventions of electric distribution specialties to his credit. He is vice-chairman of the overhead systems committee of the N. E. L. A., a member of the electrical apparatus committee and chairman of the Pacific Coast engineering committee, and he is a member of the A. I. E. E. and several other national technical societies.

L. M. KLAUBER

Lester B. Mann, who has been appointed Assistant Commissioner of Patents, entered the Patent Office in 1908 as a fourth assistant examiner. From that position he rose through the various grades to first assistant examiner. At the outbreak of the war Mr. Mann entered the military service, from which he recently obtained his release.

R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, Chicago, has recently returned from a European trip. Mr. Schuchardt visited France and England to study electrical apparatus and distribution and transmission-line development.

Harry B. Joyce, formerly power engineer of the United Electric Light & Power Company, New York, has joined the engineering staff of Johnson & Benham, Inc., engineers, New York.

Frank E. Scovill, heretofore manager of the Arkansas Light & Power Company at Camden, has been transferred to the Paragould (Ark.) office of the company in the same capacity.

E. M. Ashworth, assistant general manager of the Toronto Hydro-Electric Commission of Toronto, has been appointed acting general manager of the commission following the appointment of General Manager H. H. Couzens to the position of general manager of the Toronto Transportation Commission.

L. P. Hockett, auditor and accountant with the Public Utilities Commission of Utah for the last two years, has resigned to accept a position with the Public Service Commission of the State of Washington. The attention of the Washington authorities was attracted to Mr. Hockett's work by his efforts to obtain betterments in the accounting of public utilities before the state commissions. He was instrumental in bringing about a conference recently at Boise, attended by representatives of the accounting departments of the Washington, Oregon, Montana, Idaho and Utah commissions, at which a uniform system of accounting to be put into effect in the various states represented was taken up.

George S. Williams, who was recently appointed general manager of the Androscoggin Electric Company, Lewiston, Me., has been connected with the Central Maine Power Company for a number of years. While devoting most of his attention to his new duties at Lewiston, Mr. Williams will continue his connection with the Central Maine organization as general superintendent. Mr. Williams was born in Augusta, Me., on Sept. 9, 1882. In 1903, after studying for three years at the University of Maine, he became connected with the old Kennebec Light & Heat Company, which later became a part of the Central Maine Power Company. From June, 1903, to May, 1904, Mr. Williams worked in Augusta. He was then sent to Gardiner, where he worked for two years as lineman and inside wireman. He was later advanced to superintendent of the electrical division, and the following year the gas plant was added to his responsibilities. In 1915 he was made power solicitor of the company and two years later, when war conditions in Bath made necessary the prompt and efficient reconstruction of the entire distributing system, he was called upon to perform this important work. Three years ago he became general superintendent of the company.

H. H. Couzens, manager of the Toronto Hydro-Electric Commission, has been appointed general manager of the combined Toronto Railway Company and Toronto Civic Railways. This appointment is to take affect when the Toronto system is taken over as a civic enterprise next year.

J. L. Longino has been appointed general manager of the Pine Bluff (Ark.) Company, succeeding J. A. Whitlow, who has been made traffic manager of the Arkansas Light & Power Company. Mr. Longino has heretofore been chief engineer of the latter company's properties.

Y. Furukawa, managing director and chief engineer of the Kyushu Light, Power & Traction Company of Fukuoka, Japan, recently visited the various power plants in the Northwest on a tour of inspection of the steam-electric generating stations of the country. He is also familiarizing himself with American central-station policy.

Edward R. Davenport, for the last fifteen years sales manager Narragansett Electric Lighting Company, Providence, R. I., has resigned to become associated with the Providence banking house of Bodell & Company. In his new connection he will be vice-president of the Vale Kines Manufacturing Company, Dayton, Ohio, maker of electric motor-driven water pumps. He entered upon his new work about Oct. 15 and for the present will probably make his headquarters at Dayton. Mr. Davenport is a native of Brooklyn and is well known for his progressive merchandising and new-business policies in central-station work. He entered the employ of the Brooklyn Edison Company about twenty-five years ago as an office boy and was rapidly promoted to the assistant secretaryship. After ten years in Brooklyn he went to Providence. Mr. Davenport has for a number of years been active in the Commercial Section of the National Electric Light Association, and has contributed many addresses and papers upon merchandising methods.

E. R. DAVENPORT

Chester B. Lawson has been appointed superintendent of the electrical department of the Eastern Pennsylvania Railways, Pottsville, Pa. He succeeds H. L. Treeman, resigned. Mr. Lawson was graduated from the Pottsville High School in 1905. After completing a course in electrical engineering at Lehigh University he was employed for a time in Boston. He has been connected with the Eastern Pennsylvania Railways for the past six years.

H. L. Treeman has tendered his resignation as superintendent of the electrical department of the Eastern Pennsylvania Railways, Pottsville, Pa. Mr. Treeman was graduated from the Oklahoma Agriculture and Mechanical College in 1909 with the degree of bachelor of science, having specialized in mechanical and electrical engineering. For several years thereafter he was employed by the Edison Electric Illuminating Company, Brooklyn, N. Y., as power engineer. In 1915 he left the service of that company to accept the position of electrical engineer of the Eastern Pennsylvania Railways. He was promoted to be electrical superintendent two years ago.

H. W. Hough, for the last ten years chief electrical and research engineer for the Cleveland (Ohio) Electric Illuminating Company, on Oct. 1 joined the

H. W. HOUGH

staff of the Daniel M. Luehrs Company, industrial consulting and construction engineers at Cleveland. Mr. Hough has had experience in the design of modern power houses, substations, transmission systems and distribution systems. He has also been actively engaged for a number of years in the solution of the many industrial problems incident to the supply of light and power, particularly as applied to large electric furnaces, rotating electrical machinery of many types and electric welding and heating devices.

R. W. Davenport, a hydraulic engineer on the staff of the United States Geological Survey, has been transferred temporarily to the staff of the Federal Power Commission.

W. C. Davisson, for eighteen years connected with the West Virginia Water & Electric Company at Charleston, W. Va., has severed his connection with that company as vice-president and treasurer to engage in private business.

Charles W. Hobbs has resigned as president of the San Angelo Water, Light & Power Company, a subsidiary of the Interstate Electric Corporation of New York. Mr. Hobbs had been associated with the corporation for thirty-two years.

Robert M. de Vignier, for more than ten years a member of the engineer staff of the Western Electric Company and more recently with E. I. du Pont de Nemours & Company, has been appointed chief engineer of the American Vulcanized Fiber Company, with headquarters at Wilmington, Del.

Max Thelan, chief of the liquidation and claims division of the Railroad Administration, has resigned to resume his legal practice in California. Mr. Thelan was formerly chairman of the California Railroad Commission. He will be succeeded on the Railroad Administration by L. M. Alvoid, assistant to the director-general.

G. J. Wheat, until lately assistant superintendent of the Alameda County (Cal.) district of the Pacific Gas & Electric Company, resigned that post to become general manager of the Wheat Electric Company, electrical contractors and dealers of Santa Maria, Cal.

Dr. E. F. Northrup has resigned his professorship at Princeton University in order to devote his entire time to

DR. E. F. NORTHRUP

his work with the Ajax Electrothermic Corporation of Trenton, N. J. Dr. Northrup was recently elected vice-president of that company and is now engaged in perfecting a brass-melting furnace of this Ajax-Northrup type.

George A. Porter, who has been associated with the Cumberland County Power & Light Company at Portland, Me., for many years, has just been made manager of the company's division at Bonny Eagle, Me.

Obituary

Alexander Macauley, for the last fifteen years superintendent of the electrical department of the Beverly (Mass.) Gas & Electric Company, died at his residence in Beverly Oct. 11. Mr. Macauley was a native of Souris, Prince Edward Island, and was about fifty-six years of age. He entered the employ of the Beverly company thirty-two years ago.

A. W. Sanborn, who until recent years was associated with his son, Gerry M. Sanborn, in the Sanborn Electric Company of Indianapolis, died recently in Dover, Me., where he had been visiting. Mr. Sanborn had been in failing health for some time. He was seventy-three years of age.

C. E. Acker, who developed the first electrolytic process for the manufacture of caustic soda by the electrolysis of molten salt, known as the Acker process, died at his home at Ossining, N. Y., on Oct. 18. Mr. Acker also built the works of the Acker Process Company at Niagara Falls for the manufacture of tetrachloride of tin and carbon tetrachloride and was the first to manufacture carbon tetrachloride in America. He was born at Bourbon, Ind., March 19, 1868, and was educated at Wabash College and Cornell University. He began his business career by engaging in electrical engineering work in Chicago, continuing in this occupation from 1888 to 1893. Since that time he had been engaged in pursuits connected with chemistry and electrochemistry. He was a director of the American Electrochemical Society and a member of the Society of Arts of London, the Faraday Society of London, the American Institute of Electrical Engineers, the American Chemical Society, the Society of Chemical Industry and the Chemists' Club.

Richard Lamb, a civil engineer who died at the Methodist Hospital, New York City, on Oct. 19, at the age of sixty-one, had an interesting association with electrical development. He was the designer of an electric haulage plant on the Erie Canal, opened up the Virginia Copper Company's mine and erected its plant, and designed a plant for extracting copper from ore by electrical deposition instead of by the old smelting process. As a member of the American Road Builders' Association he did much for the advancement of highway engineering, on which he was an eminent authority. He was a member of the American Society of Civil Engineers, the American Institute of Electrical Engineers and the New York Electrical Society.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Price Problem an Embarrassing One to Electrical Trade

TWO more or less embarrassing factors confront the electrical manufacturing industry in connection with the readjustment and general tightening up of business conditions now going on. The first is that the average rise in prices since 1914 has been much less than in most other lines of trade. A prominent manufacturer of electrical equipment recently stated that a check of the price lists of two large competitors showed an average increase of 78 per cent over 1914 prices. Charles L. Eidlitz, president of the R. B. Corey Company, has calculated that the price of electrical goods has increased since 1914, on an average, 87 per cent. A general survey of the field indicates that these figures represent the average fairly well. The public is set on forcing price reductions in general trade lines where increases in price have been 100 per cent and more, and this determination is having an effect in slowing up buying in some lines of electrical goods. A reduction in prices that will meet public ideas of what is right would mean the wiping out of profits and in many cases an absolute loss.

The second factor alluded to is that many manufacturers are working on high-priced materials bought under contracts several months ago either because such contracts had to be made to secure materials or because the readjustment of conditions was not foreseen. In many cases these contracts run at least to the first of the year; therefore any reduction in raw-material prices now can have no effect. Even with materials purchased after the first of the year at lower prices, the lower costs cannot be largely reflected in finished products for several months because of the time taken in putting equipment through factory processes. The combination of circumstances, taken with the public attitude on price changes, produces a difficult situation which must be met by a frank statement of conditions that will procure a hearing, or else the industry must face losses that are undeserved.

Record Export of Transformers and Rheostats in August

EXPORTS of electrical materials amounted to $61,022,347 for the first eight months of the current year, according to the Bureau of Foreign and Domestic Commerce. This figure compares well with totals of $62,294,672 and $38,591,243 for the same period in 1919 and 1918, respectively. Exports through August are running about $500,000 ahead of 1919 on interior wiring supplies, dynamos and motors, but are behind last year's totals by about $2,000,000 on insulated wire and $1,000,000 on tungsten lamps.

The export total of $7,810,175 for last August is slightly above the present year's average. The figure represents a gain of more than $1 000,000 over the previous month and a gain of about $100,000 compared with August, 1919. Thus far the present year's volume of electrical exports is closely holding to the approximate annual total of $90,000,000 that has been previously indicated.

A feature of the exports for August, 1920, is the tremendous jump in the exports of rheostats. The total value of $730,818 sets a new high record in that line and is more than the total of all the other months this year put together. Another record was also made in August, when the previous high total of $554,576 for monthly exports of transformers that was hung up in August, 1918, was exceeded by almost $170,000. Besides the export totals of $659,200 in generators and $174,910 in carbons surpassed the best previous figures of 1920. On the other hand, the total of $2,787 recorded in August was the lowest figure yet reached in exports of carbon-filament lamps.

	— Eight Months Ended —			
	Aug., 1919	Aug., 1920	Aug., 1919	Aug., 1920
Batteries	$587,951	$444,859	$4,164,107	$4,277,326
Carbons	106,823	174,910	1,034,411	966,598
Dynamos and generators	586,211	659,200	3,621,893	4,193,364
Fans	53,099	54,911	1,191,040	860,501
Heating and cooking apparatus	124,668	118,817	1,095,415	1,164,877
Insulated wire and cables	741,443	420,208	6,991,392	4,662,652
Interior-wiring supplies	166,499	241,425	1,583,780	2,093,126
Arc lamps	3,373	711	11,786	16,324
Carbon-filament lamps	10,135	2,787	127,382	66,553
Metal-filament lamps	350,284	213,615	3,415,815	2,512,437
Magnetos, spark plugs, etc.	230,403	169,543	2,114,594	2,393,687
Meters and measuring instruments	268,448	152,696	1,461,124	1,677,969
Motors	729,608	845,729	7,111,752	7,668,715
Rheostats and controllers	45,833	730,818	336,790	1,128,295
Switches and accessories	356,676	283,900	2,432,471	2,766,189
Telegraph apparatus, including wireless	115,645	31,903	676,145	443,341
Telephones	324,755	218,073	2,491,201	2,348,098
Transformers	441,733	721,507	3,960,304	2,771,963
All other	2,472,641	2,324,563	18,898,987	19,010,332
Total	$7,716,228	$7,810,175	$62,294,672	$61,022,347

Market for Christmas-Tree Lighting Outfits Undersupplied

MANUFACTURERS of Christmas-tree lighting outfits without exception report that they are unable to fill the demand. One of the largest makers of complete outfits has been sold ahead since March 1 and has accepted no new orders since that date. Another has accepted no new orders since June, and a third, while accepting a few, has, it is said, been making no efforts to obtain additional business for a long time.

One producer is meeting with considerable success on a new lighting outfit which is now on the market for the first time and which consists of a transformer and multiple lamps instead of the usual method of series lighting. The output of this set has also been sold out for the rest of this year. Considerable complaint is heard in many cases of inability to obtain enough lamps for Christmas-tree lighting sets. According to one of the large producers of these lamps this scarcity is due to the extraordinary demand that has existed for automobile and flashlight lamps and which has largely monopolized manufacturing facilities.

Stocks with manufacturers are non-existent. The latter are concentrating their efforts upon filling all back orders by Dec. 1, but it seems that this will not be accomplished in all cases. Prices are steady, with no prospect of any change this year, it is said. One of the representative makers reports no price fluctuation since an increase of about 7½ per cent more than six months ago. A feature of the present season is the small amount of competition in this line on the part of Japanese goods. Few if any complete lighting outfits from Japan are on the market, and the number of lamps from that source is generally said to be inconsiderable.

It is a fact, however, that more than 8,000,000 incandescent lamps were imported into the United States last year at an average value of less than 2½ cents per lamp. It is evident, therefore, that the bulk of these lamps were

miniatures. Furthermore, it is known that of the miniature lamps that came into the United States in 1919 at least 75 per cent came from Japan and were designed for the Christmas-tree trade. During the first quarter of 1920 a million and a quarter of lamps were imported at an average value of 2.1 cents. Taking these figures together with the fact that certain jobbers are known to have had vast quantities of these Japanese lamps in stock after the 1919 Christmas season, it is evident that at least a few millions of Japanese lamps will be offered to buyers this year. These lamps could be obtained at retail last year for 5 and 10 cents.

American manufacturers are inclined to underestimate the number of Japanese lamps which will be available this year. Furthermore, they claim that because of the inferior quality of these foreign lamps competition will not be felt.

Fancy lamps in the shape of birds, animals, etc., seem to be scarce this year. Very few are coming in from abroad, it is said, and manufacturers here are concentrating on the regular line.

Credit Men Optimistic in Face of Lengthening Collections

AS A RESULT of decreasing demand and rapidly increasing inventories in most lines at present collections are lengthening materially, according to the credit managers of several of the leading electrical interests. One of these companies reports that from May 1 to date the average length of time in which customers meet their bills has increased 26 per cent. Another authority estimates that in the East accounts on the average are running over the normal time within which bills are met by at least fifteen days.

The root of the situation is held to be that at a time when decreasing demand dictates that stocks should be reduced manufacturers are unloading supplies upon distributers. A considerable number of cancellations and requests for extensions of time in accepting goods have resulted. With a smaller and slower turnover, many electrical firms have had to ask for paper to be accepted instead of cash, with a consequent tightening of credit and the lengthening of collections that has been noted. Furthermore, in order to liquidate stocks, price cuts have been resorted to in some cases. This price cutting has by no means been general however. The pinch is especially felt in the central district of the West, according to one of the large national organizations. This is said to be a result of the extra load entailed on banks by the carrying over of crops there. The East, on the other hand, appears to be better off than any other section as regards credit.

In general the view is taken by the leading electrical interests that the above conditions will continue and perhaps become even worse for possibly the next three months or so. Then the pendulum is bound to swing the other way, this view holds, and a period of great prosperity for the electrical trade will set in. This widespread optimism seems to be based on several factors. Among these are the opening up of European markets, expectations of a boom in the building industry next year, the fact that price cuts and cancellations have not been so general as in other lines, and also the belief that overstocking will not proceed to extreme lengths because the electrical market has all along been so greatly undersupplied on many articles.

This view is concurred in by the New York Electrical Credit Association, according to E. D. Tolles, the secretary, who sees no great change in business conditions recently that has influenced credits in the electrical industry. The number of forms used by members of the association to report delinquent customers has increased, it is true, but it is held that this fact must be discounted. One significant feature, however, is the increase in the average number of forms used per member from 1.3 in 1919 to about 1.7, the estimated average of this year. The number of delinquent customers reported to the N. Y. E. C. A. in August this year was 196, or 1.2 per member, which is the lowest average recorded since 1912 The vacation season is held largely responsible, however. The number of delinquent customers increased to 282 in September, 1920, and for the first twenty-five days of October the figure is 265, which indicates a further increase this month. These totals compare with 121 delinquent customers reported in August, 1919, 136 in September, and 226 in October. It must be remembered, however, that at present there are 50 per cent more members reporting than last year. The largest total of delinquent accounts reported to the association this year was 370 in April.

Winding Tape Slightly Lower in Price

A REDUCTION averaging about 15 per cent in the price of the high-grade cotton tapes used in generator and motor windings went into effect in several recent readjustments of quotations by leading producers, and delivery conditions are considerably improved as well. Shipments can now be made in from six to ten weeks, compared with about twelve to fourteen weeks in the early summer, on substantial orders. The supply of raw material in the hands of the tape manufacturers is on the whole excellent, but the cost of yarn continues high, notwithstanding the slump of cheap grades of cotton in the open market. Leading grades of yarn cost the tape manufacturer around $1.50 to $1.75 per pound today; wages are not being reduced as yet, and the amount of business on the books of some concerns bids fair to keep the plants going on substantially full time for many weeks. A fair average cost for sizes commonly used would be from $2 to $3 per gross yard, and it is said on good authority that prices will probably not change much until the end of the year at least. One of the leading manufacturers points out that should prices fall materially before 1921 buyers would be fairly treated as to readjustment.

Cotton sleeving is in heavy demand now, and in order to fill orders night work is being done. One concern is running three daily shifts on this class of production. Eight to ten weeks' delivery is offered. Prices average about $2 per pound, net, with 50 cents per pound extra for colors.

Metal Market Situation

COPPER producers during the past week have accepted a fairly large volume of business at a price of from 15 to 15.25 cents. In spite of this concession from the previous nominal level of 17 cents that had been maintained, there is no evidence of any sustained buying movement. Consumers seem to feel that they can obtain plenty of copper when needed at still lower prices. On the other hand, a price of 15.25 cents is below the level of production costs for more than one interest, it is stated, and some mines are expected to be forced to shut down. Production is being curtailed at present, and further reductions in output may be expected in an effort to reduce the large surplus stocks which have accumulated. The outside market is now quoting electrolytic at close to producers' prices. Some quantities are available at 15 cents f.o.b. refinery, and this price might even be shaded for October delivery.

NEW YORK METAL MARKET PRICES

	— October 18 —	— October 25 —
Copper	£ s d	£ s d
London, standard spot	93 5 0	91 10 0
	Cents per Pound	Cents per Pound
Prime Lake	16.50	nominal 15.50
Electrolytic	nominal	15.00–15.25
Casting	15.75	14.75
Wire base	19.00–19.50	17.50–18.00
Lead, trust price	7.25	7.25
Antimony	6.50	6.37½
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	7.50	7.50
Tin	37.75	39.50
Aluminum, 98 to 99 per cent	33.10	33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	14.50–15.00	13.00–13.50
Brass, heavy	7.50– 8.00	7.00– 7.50
Bass, light	6.50– 7.00	5.50– 6.00
Lead, heavy	5.75– 6.00	5.50– 5.75
Zinc, old scrap	4.50– 5.00	4.00– 4.50

THE WEEK
IN TRADE

EXCEPT perhaps that demand is less active, if anything, conditions in the electrical market are about the same as reported last week. Stocks are piling up locally, and as a result in some places sales are being made at less than cost. Generally speaking, however, jobbers are maintaining prices, not caring to take any loss on their stock just yet.

The trade generally seems to feel that the market will continue as it is until after election. Just what the after results will be does not seem clear. A slight buying movement might take place for a few days, but there seem to be no indications of any continued demand.

Building operations are slower than ever, and the dearth of new construction is bound to have a greater unfavorable reaction on the electrical market next spring.

Christmas buying by retailers has not yet started. In fact, there is every indication that last-minute buying in hand-to-mouth quantities will characterize the season.

Credits are tightening, but there does not appear to be any "strong-arm" work done in trying to shorten collections. It would not be surprising to see better collections immediately after the elections.

NEW YORK

Local market conditions remain unchanged. In all lines there is the same dullness that has marked the past two weeks. The demand is not particularly strong, as there is no new building construction under way and the consumption of wiring material is limited, as before, to extensions and some rebuilding. Stocks are reported as being from fair to good—in some cases too good. No apparent effort is being made to round out the stocks with the elections undecided and the continued instability of prices.

Prices have steadied a bit in many lines, yet there is no doubt that the market has definitely become a buyers' market. This is particularly shown in the matter of wire, which has not responded to the price recessions of last week. It has been stated that it is the last salesman to call who receives the order as he is in a position to meet any previous price. This does not mean that all sellers are after orders at any price, but that, in particular lines, many sellers are willing to get into the market in order to balance stocks. A few specialty manufacturers are guaranteeing prices to Jan. 1, 1921. Two items of electric ware have been advanced by the Westinghouse Electric & Manufacturing Company.

Collections have steadied at fifty to sixty days. Creditors are being very closely watched but are not being crowded.

Wire.—Stocks are not moving at the prices conceded last week. Buyers may be expecting some further recessions.

Hollow Ware.—Some manufacturers have good stocks on hand, but most jobbers report a great scarcity. The Christmas demand is fair. Prices have remained stable.

Heaters.—The market has been good in heaters. Shipments are coming through well and stocks are not depleted. Prices remain steady.

Friction Tape.—No change in prices has yet resulted from the drop in the price of cotton. Shipments and stocks are good and the demand is fair. Half-inch black is quoted at 50 cents per pound.

Washing Machines and Vacuum Cleaners.—Sales have been very good during the past few weeks, probably as a result of the electrical show, and shipments are coming in well. A few manufacturers have found it desirable to reduce their prices somewhat.

Schedule Material.—The market is inclined to be erratic. Pull sockets are off, with large stocks on hand. Material containing porcelain is yet very difficult to obtain.

Rigid Conduit.—Delivery is uncertain. Prices are somewhat unreliable owing to the spotty condition of stocks both as to sizes and as between jobbers.

CHICAGO

The lethargy which has gripped all other lines of trade has crept speedily through the electrical trade during the past fortnight, sharp complaint being heard about decreased business on all sides. The only exception is that business originating in maintenance departments of public service corporations and municipalities continues good. Retail trade of all sorts is only a fraction of the spring volume, even rural districts reporting a distinct slump. Jobbers' accumulation of stock is now a problem in many lines.

There is a widespread demand for lower prices. Students of the trade, who believe cuts at present to be impossible, feel that a guaranty of prices for six months would do much to restore confidence and induce buying, as it is known that much needed buying is being indefinitely delayed. The influx of job seekers has reached sizable proportions and seems to include men from all over the East. Shoe workers from Lynn, machinists from Waterbury and mechanics from Detroit are competing with Chicago men for jobs, in a decreasing market, numerous lay-offs and reductions being recently noted.

Motors.—Small motors, from 1 hp. to 15 hp., are more easily obtained, as many small dealers who have been hoarding these scarce sizes are putting them on the market, several assortments of from 25 to 250 hp. being recently reported. Jobbers and makers are still behind, but demand has materially lessened. The fact that local power companies are at their load limit and can assume no additional contracts for service is hurting motor sales.

Protective Apparatus.—Lighting arresters, circuit breakers and oil switches are still behind in production. No talk of price cuts is heard, plenty of business at current prices being reported on the books of manufacturers.

Copper Wire.—Recent sharp breaks in the copper market was immediately reflected in the establishment of lower prices on wire. Bare copper is now on a 22-cent base, which means $22.25 per 100 lb. on No. 8 in 200-lb. lots, and weatherproof is on a 25-cent base, or $28 per 100 lb. for No. 12 triple-braid in 500-lb. lots. Demand is normal and deliveries are good, bare in car lots being available in three weeks or less.

Insulators.—Porcelain remains the hard problem of the line-material list, deliveries still ranging around four months. On some special heavy disk-strain insulators delivery cannot be obtained under a year. The recent destruction of one of the Hemingray factories by fire has delayed some deliveries of glass, but production will be back to normal in about two weeks. No price changes are noted in either porcelain or glass.

Poles.—Stocks are getting badly broken, the more popular sizes being hard to find, which is a normal condition for this time of year. Preparations are being made for the approaching producing season in the North woods.

Lamps.—Miniature-lamp makers have been hard hit by the slump in the automobile industry, and enormous stocks are accumulating, actually millions of automobile lights being in warehouses. Lamps for industrial and domestic use are in reduced demand, but railroad buying has reached such a volume as to make good business. No price changes are foreseen.

Washing Machines.—No material change in the washing-machine market is noted. Some dealers are asking for guaranteed prices.

BOSTON

Business receded somewhat during the past week in both jobbing and manufacturing circles. A representative Boston distributer reports that the number of orders coming in is running about 20 per cent below the rate of last month, but that the size of individual orders is well maintained. A waiting attitude among buyers is the result of recent price reductions in various lines of textile and leather manufacture. Weatherproof wire is weaker in price, but most electrical commodities are changing hands at firm prices except

where overstocks or close competition pull down quotations. Collections are only fair. Large engineering establishments are completing important jobs placed under contract some time since, but new work is marking time before the presidential election, which unquestionably is a factor in the current hesitation to expand business on a large scale. Throughout New England manufacturers report easier labor conditions. Brass manufacturers in the Naugatuck Valley of Connecticut have gone upon a five-day week to avoid extensive lay-offs. Press statements to the effect that the Massachusetts plants of the General Electric Company will be indefinitely curtailed after Nov. 24 are incorrect, only the usual suspension to take the yearly inventory being planned.

Wire.—Weatherproof wire dropped from a 26-cent to a 23-cent base during the week. Deliveries are a little tight on this material. Rubber-covered wire is selling at $10.50 to $11 per 1,000 ft. in the No. 14 size, in 5,000-ft. lots. One jobber had about 3,000,000 ft. on hand Saturday.

Rigid Conduit.—Shipments continue uneven and stocks are spotty. Moderate-sized demands are being cared for, however. The tube mills are extremely busy producing oil piping, which cuts into conduit deliveries. Prices of typical sizes are: Black, 1-in., $189.50 per 1,000 ft., and ½-in., $96; for galvanized, 1-in., $200, and galvanized, ½-in., $102.

Motors.—Deliveries range from three or four weeks to six and eight months. Some manufacturers are sold out until the end of next spring, while others, through enlarged plants and increasingly popularity of products, can fill orders quite promptly in comparison with the former. Prices still hold firm.

Controlling Apparatus.—A very active demand is noted. Prices have remained steady since the last advance of about 15 per cent in August. Improved motor deliveries are pressing the controller manufacturers in some cases, a fair average delivery on smaller equipment being two months.

Non-Metallic Flexible Conduit.—Stocks are of liberal size, but prices do not show any tendency toward sagging off. The consumption of this material holds up well. Quotations are $33.50 per 1,000 ft. for the ⅜-in. size and $36.50 per 1,000 ft. for ½-in. size, both in 5,000-ft. lots.

Fixtures.—Business is brisk and prices are about 10 per cent below quotations of a few months ago. Stocks are in fine shape, and a splendid trade is anticipated during the next two months. Portable lamps are in healthy demand, and a leading dealer states that prices are now down to about 25 per cent above pre-war figures, representing a total reduction of 50 per cent from his peak quotations.

Flexible Armored Conductor.—No. 14, single-strip, sells for $85 per 1,000 ft. in 1,000-ft. to 10,000-ft. lots. One jobber had 200,000 ft. in stock at the end of last week. Demand is not very heavy.

Radiators.—Trade is excellent, with steady prices. Deliveries are good and stocks are fairly complete.

ATLANTA

The past week has brought no stabilizing influences in the Southeastern field. Business in the agricultural districts has been discouraged by the many interpretations placed on the government's attitude toward assistance to the section in the financing of the cotton crop. It would seem, however, that the suggestion put forth at the meeting of the American bankers' convention for an export corporation and the summary of facts as outlined by the secretary of the New Orleans Cotton Exchange should go far to restore confidence in continued business prosperity. Last year's consumption of cotton was in excess of the supply, and all indications point to the same condition existing this year. Nevertheless, the uneasiness has had its effect on both the jobbing and retail trades and business has slackened up all along the line. Jobbers report the continued movement of the electrical material required in the building trades, and contractors continue busy on existing work, but inquiries and orders have slumped badly. Some jobbers express the opinion that a reduction in price in certain lines is inevitable, but all jobbers are of the opinion that the present slump is temporary and will probably last only until after the presidential election. Hardware jobbing firms report heavy cancellations of orders and are in turn canceling orders on manufacturers. This will be reflected somewhat in the electrical jobbing lines on building specialties. Practically all lines of electrical material are on hand in reasonable quantities, except certain classes of wiring devices in which porcelain enters.

Wire.—An average reduction of 2 cents per pound is quoted on both rubber-covered and weatherproof wire, effective at once. While weatherproof continues somewhat short in popular sizes, the rubber-covered stocks are in very good shape, with factory shipments running from three to eight weeks. The demand, due in a measure to back orders on weatherproof, continues to hold fairly well.

Flexible Armored Conductor.—Improvements in shipments are bringing about a slow betterment in stocks, though deliveries continue somewhat slow. New prices are offered in this line with two-wire No. 14, lots of 1,000 ft. to 2,500 ft., at $110 per 1,000 ft. Back orders continue to hold up the demand in this line.

Tape.—No break in the price of tape has yet been announced, though jobbers expect that the conditions in the rubber and cotton markets will be reflected at almost any moment in a sympathetic price reduction in this line. Prices: 8-ounce roll, ¾-in. wide, lots of 25 lb. to 100 lb., 71 cents per pound.

Poles.—The rebuilding of distributing lines in anticipation of the winter season is sustaining the market for poles. The car shortage continues to be the principal obstacle in the way of a plentiful supply as stocks at point of shipment are reported good. Chestnut poles are becoming more difficult to obtain and are not up to former quality. Price: 30-ft., $6.

Rigid Conduit.—Satisfactory stocks of black pipe are reported by all jobbers, but galvanized, especially in ½-in. and ¾-in. sizes, continues very scarce. Prices: Lots less than 2,500 lb., black, ½-in., $8.89; ¾-in., $11.80; 1-in., $17.44; 2-in., $37.90. Galvanized, ½-in., $9.40; ¾-in., $12.49; 1-in., $18.46; 2-in., $40.18.

Cut-Out and Outlet Boxes.—Stocks of this material have improved in the past two weeks and, with the exception of special sizes, are reported in fair shape. No reduction in prices is yet reported, though the demand is off quite noticeably.

ST. LOUIS

The past week has seen a slightly more active market than last, but there still remains the tendency both among large buyers and the retail trade to defer making any but necessary purchases. In this way the St. Louis electrical market is being affected by decreasing prices in other lines, but so far the electrical industry here has made little effort to follow the general trend. St. Louis jobbers have large stocks in a number of lines and demand has dropped off, but prices continue to remain firm with a very few exceptions.

Contractor-dealers are still doing a fair volume of business, but much of it is due to the fact that there are numbers of buildings on which work started last spring and which are just now getting to the stage where the electrical contractor can do his work. Since Aug. 1 no building operations of any consequence have been started, and a slump for the contractor-dealer can be expected whenever the present construction is completed. There is still a good volume of house-rewiring business, but this does not ordinarily form a great part of the contractor's business.

Retail dealers report only a small volume of business and a decided slump in the sale of appliances. The public is taking precisely the same attitude toward the electrical dealers that it has taken toward retailers in other lines, that of expectation of a price drop.

Collections are generally very slow, and some jobbers and manufacturers report turning down new accounts or limiting old ones mainly because of credit conditions.

Weatherproof Wire.—This is one item on which the market is showing signs of weakness. There are large stocks here and demand has fallen off considerably. These conditions have induced some jobbers to show a willingness to unload their stocks at whatever they can get, while others

are holding as firmly as possible in the belief that the tactics of the former will relieve the market and bolster prices again. The current quotation is 26 cents, but some sales are being made several cents below this price.

Lamps.—Stocks of lamps have bettered materially, and the situation is easier, though demand continues steady. The stocks are not yet complete because of the difficulty in getting the type C lamp in the 75-watt and 100-watt sizes, and it will probably be several months before jobbers have their reserve stocks complete. Series lamps for street-lighting purposes are coming in better than they were six and eight weeks ago, and jobbers have fair stocks to cope with a steady demand.

House-Type Meters.—Central stations are still demanding good quantities, but stocks have become larger owing to better deliveries from manufacturers. The central stations are using them mostly for replacements and remodeling.

Lamp Cord.—This is available in moderate quantities in most sizes, but the small stranded wire remains scarce. Stocks of the silk-covered cord are decidedly spotty, and many users are turning to the mercerized cotton cord of which there is a fair supply. No. 18 twisted pair is being quoted at $28.50 per 1,000 ft., net, in average lots.

Sockets.—There are more sockets in stock here than the demand can take care of, but jobbers are not wavering on their prices as the belief prevails that as soon as building starts again the manufacturers will not be able to keep up with orders. The prices quoted are 51 cents net for pulls, 28 cents for keys and 26 cents for keyless in case lots.

Fuse Plugs.—There is a good supply and a fair demand. Immediate delivery can be made on average quantities. Up to 30 amp. the price ranges from $4.75 to $5 per 100 according to quantity.

Panelboard Switches.—Manufacturers here report that they are running about 15 per cent behind on their orders, that production is normal and that no slump has been felt.

SALT LAKE CITY—DENVER

Many electrical jobbers are struggling to keep from becoming overstocked. When merchandise was scarce they ordered from various markets to insure being in a position to meet the demand. Now factories are speeding up production and pyramided orders are beginning to pour in. The result in many cases is a resort to cancellation. Many manufacturers are showing a disposition to hold jobbers to their contracts. Crops are moving satisfactorily and money is beginning to circulate more freely. The coal mines are running full blast. The metal-mining business is in bad shape, and mining activity generally is at a low ebb. Most jobbers are stocking extensively in anticipation of better times although they are not looking for immediate relief. They are confident that by spring business will be in a far better way. Only a few of the more timid and pessimistic are holding back. Conditions are better for electrical contractors. A few sizable building jobs are getting under way and prospects for more contracts are brighter.

Electric Ranges.—Though the market is best in the summer months, business is still holding up. Already this year one jobber has disposed of eleven carloads.

Washers.—The thing of chief interest in this line is the overabundance of stock. Warehouses are being taxed to the limit. The market is slow.

Heating Appliances.—Dealers are having no trouble to stock up with best sellers in the hollow-ware line. They buy from jobbers only as they are able to sell, exhibiting a marked tendency to play safe.

Motors.—This phase of the market seems to be one of the bright spots. Dealers sell all they are able to secure from jobbers. The demand is especially good for sizes ranging from 2 hp. to 20 hp.

Transformers and Meters.—There seems to be some scarcity of stocks. The demand is good.

SEATTLE—PORTLAND

The change in business conditions in the Northwest from week to week during the past month is negligible. Jobbers report a quiet market with practically no movement of heavy power apparatus, transmission equipment and house-wiring devices. Domestic appliances, including expensive merchandise, are moving well and farm-lighting plant sales are going as well as was anticipated, or even better. Retailers state that counter business is holding up well with percolators and toaster stoves leading the movement of socket devices. Heaters are in big demand, and retailers are having a hard time keeping stocks filled. Lamps and flatirons also enjoy good sales. Shortages have not been overcome in heating devices, small motors, washing machines and porcelain ware. Shipments are coming through in satisfactory manner, and, everything considered, stocks are in fine shape. Prices remain practically the same. Residence construction is dropping off, and the building of large structures heretofore mentioned will probably be postponed until spring or maybe later.

Portland jobbers report that business continues good but that part of the volume is in filling back orders, although there is considerable new business. Transportation is catching up with orders, which means that stocks will show further improvement. Pipe and porcelain recently advanced to cover increased freight charges, but wire registered another drop. Certain lines of heavier equipment have advanced about 3 per cent. The jobbers will probably absorb the increased freight charges on lighter equipment. Collections are slow. To date the movement of crops has apparently made no change in electrical industry.

Flatwork Ironers.—This device, while comparatively new in this section, is attracting considerable attention. Dealers are demonstrating it at every opportunity and report that sales are quite satisfactory.

Heating Appliances.—Some dealers hold that this season will establish sales records, while others are not so optimistic. Stocks are in good shape and replenishments are easy to obtain. Prices show no particular change.

Vacuum Cleaners.—This device, which is always moving in this territory, is going better than ever this fall. Stocks are in good shape and shipments of the 32-volt type are moving exceptionally well, especially in eastern Washington.

Storage Batteries.—Stocks in most cases are low owing to fall business, which was slightly heavier than was anticipated. Sales are still going along well and are expected to continue.

SAN FRANCISCO

All reports show a tremendous amount of new building in southern California, especially in Los Angeles, where building permits for 1920 will total well over $50,000,000 in value, the major portion of which is for big jobs. In other parts of the state a steady decrease is noted. Buying consists of small unit packages, except where substantial price or delivery advantages are offered.

Roughing-in Material.—Los Angeles jobbers and dealers say that it is impossible to maintain any stocks of rubber-covered wire, conduit boxes, condulets and schedule material because of the demands of new buildings.

Insulators.—The bay district is experiencing a complete dearth of split porcelain knobs in standard sizes, and because of this fact it is temporarily possible to use solid porcelain knobs.

Lamp Cord.—Although regulations require the use of asbestos-protected lamp cord for certain type C lamp installations, comparatively little of this class of cord has been sold recently. However, several good sales to fixture houses are reported, and the ratio of use seems to be increasing.

Washing Machines.—More conservative buying is the rule. Several well-established dealers have found themselves in financial difficulties because of overbuying. A ten-lot or a twenty-lot price seems to be most favorably regarded.

Farm Plants.—After a sale that decreased during the crop-moving months a better rate of sale is now the rule, for the ample 1920 crops are now disposed of and farmers not only have more leisure to talk to agents but ample means to pay for the plants. An especially good sale of 32-volt household appliances is reported.

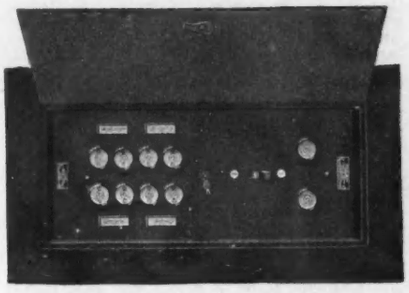
Radiators.—A splendid sale of radiators is predicted for the 1920-1921 season, judging from advance orders. The field has never been campaigned before so thoroughly.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Lighting Panels for Residences

A complete equipment of service-switch main and branch connections is mounted upon a molded composition



DEAD-FRONT PANEL FOR RESIDENCES

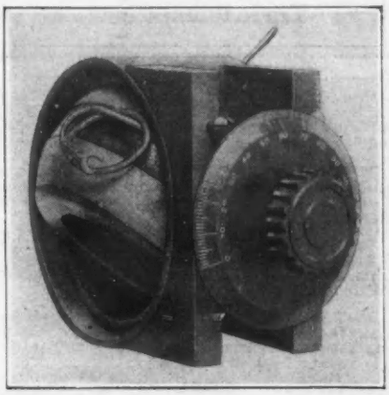
base in the panels recently brought out by the Benjamin Electric Manufacturing Company, Chicago. This panel is made in both open-front and dead-front for any number of circuits up to ten.

Combination Switch and Receptacle Plate

A new type of combination switch and receptacle plate with removable door is being offered by the Peerless Light Company, Chicago. This plate is suitable for the old-type No. 1908 receptacle or the new-type standard flush receptacle.

Variometer

A variometer known as type ZRV, with the outer winding made in the form of a section of a sphere, form-



BALL MAY BE CONTINUOUSLY REVOLVED WITHOUT BREAKING CONNECTIONS

wound and supported inside a 4½ in. bakelite tube, while the inner winding is directly on a hardwood ball treated to exclude moisture, has been placed in production by the Clapp-Eastham Company, Cambridge, Mass. The maximum inductance is 1.25 millihenries and the minimum inductance 0.1 millihenry.

Skeleton Bell

Simplified construction which eliminates several of the features that often caused trouble in electric bells is the principal point of interest in the new line of skeleton bells designed by the Signal Electric Manufacturing Company, Menominee, Mich. The armatures and strikers of these bells are in one piece, the binding posts are insulated and non-turning, the contacts are of heavy coin silver, and the adjustments are simple and positive.

Continuous-Current Radio Transformers

To produce practically unfluctuating direct current at 375 volts and 550 volts a transformer in 50-watt and 200-watt sizes respectively has been developed by the Acme Apparatus Company, 27 Windsor Street, Cambridge, Mass., for use with rectifying tubes, a small condenser and an "Acme" 1.5-henry choke coil. These transformers are also provided with windings for use in heating the filaments of the rectifying tubes and the oscillating tubes used in the generation and modulation of the continuous wave current.

Insulating Varnishes

A complete line of insulating varnishes and japans suitable for many applications in the manufacture and maintenance of electrical equipment, including the impregnation of coils wound with untreated fibrous materials, has been placed on the market by the General Electric Company, Schenectady, N. Y. The varnishes are divided into two general classes, known as black varnishes and yellow, or clear varnishes. Both general classes are subdivided into several classes for special uses.

Notes on Recent Appliances

Automatic Household Refrigerator

A refrigerator has been developed for household use by the Refrigo Corporation, Milwaukee, Wis.

Tabletop Dishwasher

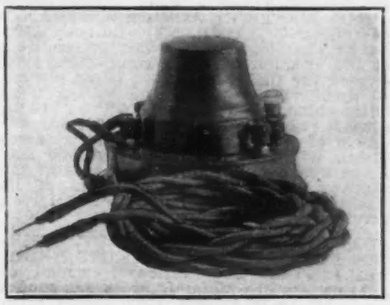
A new model dishwasher is being manufactured by Mermaid Dish Washer Company, Middletown, Conn.

Heater for Running Water

An electric heater to be attached to the faucet directly or by means of a rubber hose has been developed by the National Electric Water Heater Corporation, New York City. This device heats the water as it flows through from the faucet.

Buzzer for Testing Electric Wires

The Emka buzzer tester brought out by the Electric Signal Manufacturing Company, Inc., 31 Tremont Avenue, Orange, N. J., may be used for testing

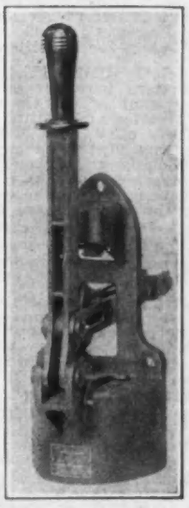


FOR TESTING CIRCUITS OR CONTACTS

open or short circuits in houses, or factory wiring, motor windings and other electrical circuits. This instrument is a combination of buzzer, telephone connections and batteries in one set.

Operating Levers for Oil Circuit Breakers

Improvements have recently been made by the General Electric Company in the levers of oil circuit breakers which are operated manually and do not require extra heavy leverage to close the breakers. The new levers are of the same size for breakers of all capacities within the range of application, all parts except the links



STANDARDIZED IN ALL SIZES

being mutually interchangeable. This standardization results in few parts per handle, facilitating repairs and adding to the uniformity and appearance.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

VICTOR B. SEIDEL, president of the Seidel Engineering Company of Tulsa, Okla., has established an electric welding industry catering to oil-field equipment in the Southwest. Mr. Seidel is sending a portable electric welding outfit out into the oil fields.

THE WESTERN APPLIANCE MANUFACTURING COMPANY, Railway Exchange Building, Seattle, has let contract for the erection of a one-story factory, to be used for the manufacture of an electrical appliance known as the Mercer ironing machine. The structure will be 110 ft. x 90 ft. inside and will cost $25,000 exclusive of equipment. The plant, it is reported, will have a capacity of 500 machines within ninety days. Officials of the company are C. N. Biggs, president; T. H. Vanasse, vice-president, and C. M. Mercer, secretary.

DATA ON FIXTURE MANUFACTURERS' PURCHASES OF SOCKETS BEING COLLECTED.—The National Council of Lighting Fixture Manufacturers has sent a questionnaire to its members asking them for information on the monthly purchases of different types of sockets during the past year. Members are asked whether they purchase from manufacturers direct or from jobbers.

INVOLUNTARY PETITION IN BANKRUPTCY FILED AGAINST BLUE BIRD.—An involuntary petition in bankruptcy has been filed in the United States District Court at St. Louis against the Blue Bird Appliance Company, organized several years ago as the selling agency for the Blue Bird Manufacturing Company, washing-machine manufacturer. The latter company was recently taken over by the Davis Sewing Machine Company of Dayton, Ohio, and will be removed to that city within the next year. At the time the company was purchased it was understood that creditors of the appliance company had been given a satisfactory settlement of their claims, and the present involuntary petition in bankruptcy comes as a surprise. The claims filed by creditors amounted to approximately $30,000, and the petitioners claim that in the last four months the company has preferred certain creditors with money and property.

THE ILG ELECTRIC VENTILATING COMPANY is moving into its new plant at 2850 North Crawford Avenue, Chicago. The new building has 100,000 sq.ft. of floor space and provides for doubling the output.

CLARENCE C. BRINLEY has been retained as Eastern manager of the trolley carrier department of the Conveyors Corporation of America and will be attached to the New York office, 110 West Fortieth Street. He was first connected with the C. W. Hunt Company and went to the Conveyor's Corporation from the Gifford-Wood Company. During the war he was conveyor engineer for the Air Nitrates Corporation.

THE AMERICAN STEAM CONVEYOR CORPORATION, 326 West Madison Street, Chicago, announces a change in name to Conveyors' Corporation of America.

J. M. BARR is now associated with the Mechanical Appliance Company, Milwaukee, Wis., as general manager. He was formerly connected with the Westinghouse Electric & Manufacturing Company, Fairbanks, Morse & Company and the Howell Motors Company.

FIXTURE MEN PREPARING FOR BUFFALO FIXTURE MARKET NEXT FEBRUARY.—Plans are going ahead for the second fixture market of the National Council of Lighting Fixture Manufacturers at Buffalo during the week of Feb. 14. This will be staged in conjunction with the annual convention of the council and also of the Lighting Fixture Dealers' Society of America. Representatives of the Glassware Guild and the manufacturers of fixture accessories will also be present. The market, which was held last year for the first time, will be established in the Elmwood Music Hall, where space has been provided for seventy-four principal booths, with room for a number of smaller booths that will bring the total up to approximately 100. Each of the principal booths, it is stated, will be wired for 2,000 watts. Charles H. Hofrichter, 8410 Lake Avenue, Cleveland, Ohio, is secretary of the National Council of Lighting Fixture Manufacturers.

HOOVER SWEEPER CELEBRATES TWELFTH BIRTHDAY.—The Hoover Suction Sweeper Company, Canton, Ohio, recently celebrated its twelfth anniversary. The machine was originally manufactured in 1908 in a small room in Canton, from which status it has grown rapidly, except for a few lean years when the machine as well as the market had to be developed, until now its sales organization comprises, according to W. H. Hoover, president of the company, eighty divisional and district managers, 650 salesmen and altogether in the organization 1,800 people.

SANFORD RILEY COMPANY BUILDS LARGE SINGLE-STOKER.—The Sanford Riley Stoker Company, Worcester, Mass., has received an order from the Public Service Electric Company of New Jersey for one of the largest single-set stoker installations ever built, the equipment to be installed in the Burlington generating station. Two B. & W. boilers are being equipped, each boiler having 14,180 sq.ft. of heating surface. The projected grate area is about 310 sq.ft., and the boilers are set with the bottom of the front header 12 ft. above the floor line. The tubes are 20 ft. long and the furnace dimensions are: Width, 28 ft. 8¼ in.; length from inside front wall over rear end of stoker, 10 ft. 10⅜ in. Each boiler will be furnished with an eighteen-retort, extra-long Riley underfeed stoker. The maximum capacity of each stoker is about 11 tons of coal per hour, corresponding to an overload of about 350 per cent on the boiler. Each stoker will be equipped with six two-speed Riley gear boxes, and an individual four-speed induction motor of the General Electric K-T type will be provided for each gear box, giving a range of eight stoker speeds. The largest stokers previously made by this company were of the sixteen-retort size.

Supply Jobbers' Notes

THE PIEDMONT ELECTRIC COMPANY, Asheville, N. C., has had its territory enlarged to cover both North Carolina and South Carolina for the distribution of A B C electric washers and is starting on an active campaign for their sale.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, New York, has reported for the nine months ended Sept. 30 gross sales of $5,752,136, as compared with $4,976,213 for the corresponding period of 1919, an increase of $775,923.

EMIL ZINSMEYER, until Oct. 1 sales manager for the Frank Adam Electric Company, St. Louis, Mo., has announced his resignation to become connected with the Electrical Warehouse Company of Detroit, Mich., electrical jobber. Mr. Zinsmeyer was with the Frank Adam Company for nearly twenty years. The vacancy created by his resignation is being filled by Phil Rabon, who has been on the sales force of the Frank Adam Company for several years.

Foreign Trade Notes

THE INDUSTRIAL ENGINEERING COMPANY has appointed R. G. Lee as general manager of the company in Canada and the United States. Mr. Lee has been power manager of the Toronto Hydro-Electric System for the past seven years. The business of the Industrial Engineering Company will be divided into two departments, the first, that of consulting engineering and the second that of handling electrical apparatus and machinery. The company will have offices in Toronto and Windsor in Canada and in Detroit, Cleveland and Buffalo in the United States. H. C. Betiam, formerly with the Toronto Hydro-Electric System, has been appointed manager for the district of Toronto.

THE CANADA WIRE & CABLE COMPANY has appointed W. R. Greenshields as assistant sales manager. He has been in the service of the company for nine years.

THE ENGLISH ELECTRICAL COMPANY, LTD., London, Eng., has recently established offices in the Transportation Building, Montreal, Quebec. The company is a consolidation of the Dick, Kent Company, Ltd., Preston, England; Coventry Ordnance Works, Coventry, England; Williams & Robinson, Rugby, England; Phoenix Dynamo Manufacturing Company, Ltd., Bradford, England, and Siemens Brothers Dynamo Works, Ltd., Stafford, England. Owing to the recent purchase of the Siemens works at Stafford, the English Electric Company will take charge of the business in Canada formerly conducted by the Siemens Company of Canada, Ltd. C. W. Stokes is the Canadian manager.

FOREIGN GOVERNMENT BUYS EXPANDED STEEL POLES.—The Italian State Railways are reported to have placed an order for 21,800 one-piece steel poles with the Italian plant of the Bates Expanded Steel Truss Company. These poles are to be used for the electrification of steam railroads, as are other similar poles which have been ordered by the Royal Swedish Railways and by some of the South American governments.

TAIT'S ELECTRICAL DIRECTORY.—The 1920 edition of this reference book, covering Australia and New Zealand, is now available and can be obtained from Scottish House, 90 William Street, Melbourne, Australia. The volume contains detailed data on central stations in Australia and New Zealand and also on electric plants at coal mines in New South Wales.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A Norwegian firm (No. 33,903) is in need of electrical equipment and supplies such as insulators, insulated and non-insulated copper wire, transformers, instruments and apparatus for generating stations, and all supplies for power transmission and house installations.

Trade Publications

STORAGE BATTERY LOCOMOTIVES.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 231, covering storage battery locomotives for industrial plants.

MINING MACHINES.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 241, covering its 35-B Shortwall mining machine.

LOCOMOTIVE CONTROLLERS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 204, covering its locomotive controller.

ROTARY COAL DRILLS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 243, covering electric rotary coal drills.

BULLETIN INDEXES.—The General Electric Company, Schenectady, N. Y., has issued indexes to its descriptive bulletins and sheets and to its supply-part bulletins.

WIRE AND CABLE.—The Habirshaw Electric Cable Company, Yonkers, N. Y., has issued a manual covering its wires and cables.

FUSES.—A. F. Daum, Pittsburgh, Pa. has issued bulletin No. 20-I, covering refillable cartridge fuse shells.

CONVENIENCE OUTLETS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued publication No. 857, covering the application of receptacles in the "convenience outlet" campaign.

ENGINEERING ORGANIZATION.—Ford, Bacon & Davis, engineers, 115 Broadway, N. Y., have issued a pamplet covering their service.

ELECTRIC COAL CUTTERS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 209, covering electric coal cutters.

STORAGE BATTERY LOCOMOTIVES FOR MINES.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 312, covering storage-battery locomotives for mines.

ELECTRIC ENTRY DRIVERS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 269, covering electric entry drivers for coal-mining operations.

MINE LOCOMOTIVES. — The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 263, covering mine locomotives.

SHAFTING EQUIPMENT.—The A. & F. Brown Company, New York, have recently issued catalog No. 66, covering shafting, pulleys, clutches, gears, sheaves, etc.

COPPERCLAD WIRE.—The Copper-Clad Steel Co., Rankin, Pa., has issued for distribution a booklet on its "copperweld" wire products.

MARINE PUMP. — The Worthington Pump & Machinery Corporation, 115 Broadway, New York, has just issued a new illustrated 125-page catalog, No. BK-3000, covering its line of marine pumps and auxiliaries.

New Incorporations

THE ROYAL ELECTRIC COMPANY, with offices at 12 East Sixth Street, Chattanooga, Tenn., has just been incorporated. The company has been doing business for some time and has the Tennessee and Georgia territory for the P. A. Geir Company's line.

THE FIRST NATIONAL LIGHTING CORPORATION has been incorporated under the laws of the State of Ohio with a capital stock of $100,000 to manufacture and distribute commercial and industrial electric lighting fixtures in all the territory east of the Mississippi River. The officers of the company are Joseph L. Jaffe, president; William S. Kiesel, vice-president, and C. H. Heide, secretary-treasurer. Offices and showrooms have been opened at 2030 East Twenty-second Street, Cleveland, and it is stated that the new factory will be in full operation this fall. The company proposes to manufacture a standardized line of commercial and industrial fixtures.

THE MARTIN WRIGHT ELECTRIC COMPANY, Dallas, Tex., has been incorporated with a capital stock of $20,000 by Martin Wright, E. B. Zoller and L. B. French.

THE MOUNT CARMEL LIGHT & POWER COMPANY, Marion, Va., has been incorporated with a capital stock of $5,000. W A. Scott is president and C. W. Respass is secretary.

THE ROYAL ELECTRIC COMPANY, Chattanooga, Tenn., has been chartered with a capital stock of $30,000 by F. E. Bryant, F. B. Dickinson and J. B. Milligan.

THE ALDERSON (W. VA.) ELECTRIC APPLIANCE COMPANY has been incorporated with a capital stock of $10,000 by L. E. Collins and R. B. Beadles.

THE OWASSO (OKLA.) POWER & LIGHT COMPANY has been chartered with a capital stock of $10,000 by E. L. Mayfield, B. Swift and J. E. Moore.

THE WEST HARRISONBURG LIGHT COMPANY, Harrisonburg, Va., has been incorporated with a capital stock of $5,000. H. A. Logan is president, and J. S. Flory is secretary of the company.

THE TUCKER-PARTHREE ELECTRIC COMPANY, 122 Hollingsmith Street, Baltimore, Md., has been incorporated with a capital stock of $50,000 by Francis Tucker, Clarence E. Parthree and Isaac T. Parks, Jr.

THE HIGH TENSION SUPPLIES COMPANY has been incorporated in Delaware with a capital of $100,000, to manufacture electrical appliances, by F. Hoey, Frederica, Del.; R. H. Kenney, Dover, Del., and D. T. Swing, Ridgely, Md.

THE RUBIN ENGINEERING CORPORATION has been incorporated in Delaware with a capital of 100,000 to make mechanical and electrical appliances, by F. R. Hansell, J. V. Piurm and E. M. Macfarland, Philadelphia, Pa.

THE BUFFALO REFRACTORY CORPORATION has been incorporated in Delaware with a capital of $100,000, to manufacture heat and electric resistance products, by L. H. Melwood, J. M. Mills and W. H. Kelly, Buffalo, N. Y.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

EAST LEE, MASS.—The erection of an electric power plant on the Housatonic River is being planned for. Carl Wurtzbach, High Street, Lee, is interested.

TERRYVILLE, CONN.—The Eagle Lock Company contemplates enlargements to its power plant, including the installation of new equipment.

Middle Atlantic States

FILLMORE, N. Y.—Application has been made to the State Public Service Commission by the Fillmore Electric Company for authority to erect an addition to an electric plant in Genesee Falls. W. L. Young, Fillmore, is president.

FREEPORT, N. Y.—The Common Council has had plans prepared for extensions and improvements to the municipal power plant to cost about $100,000. Work will be started at an early date.

HAMMOND, N. Y.—The Hammond Light & Power Company has applied to the Public Service Commission for permission to erect electric plants in the towns of Morristown and Hammond.

KINGSTON, N. Y.—The Kingston Gas & Electric Company has applied to the State Public Service Commission for authority to operate in the towns of Hurley, Ulster and Esopus.

LEWISTON, N. Y.—Application has been made to the Public Service Commission, Second District, by the Lewiston & Lake Shore Power Company for authority to issue $15,000 in bonds, the proceeds to be used to improve its property, including the purchase of new meters and transformers, improvements to its distribution and municipal system in Lewiston and the distribution system on the Fort Niagara Beach and Lake Road, new equipment in the Youngstown and Lewiston substations, etc.

NEW YORK, N. Y.—Bids will be received by the Superintendent of School Buildings of the Board of Education, room 2800 Municipal Building, Manhattan, until Nov. 3 for the installation of electric equipment in the new Public School No. 62, on Leggett Avenue, Borough of the Bronx.

OSSINING, N. Y.—Bids will be received until Dec. 2 for the erection of a prison building at the State Prison to cost about $325,000. Considerable electrical equipment will be required. L. F. Pilcher, Hall of Records, New York City, is architect and engineer.

MAURER, N. J.—The Barber Asphalt Paving Company, 233 Broadway, New York City, contemplates rebuilding its power plant, reported to have been damaged by fire to the extent of $3,000,000, including machinery. Electric traveling cranes, etc., will be installed.

MILLBURN, N. J.—Bids will be received by Dean Emery, president of the Board of Education, until Nov. 8 for electrical work, the installation of electric equipment, etc., in connection with the proposed new addition to the Wyoming School on Myrtle Avenue.

NEWARK, N. J.—The Lyraphone Company, Woodward Avenue, has plans under way for the construction of a power house, 25 ft. x 36 ft., at its local plant.

TUCKERTON, N. J.—Application has been made by the Atlantic City Electric Company, Atlantic City, for the erection of a transmission line to the radio station here, to be operated in the future by the United States Radio Supply Company. The municipal officials are also negotiating with the Atlantic City company for the installation of a local commercial system, including street-lighting and general service.

LEBANON, PA.—The Cornwall Railroad has plans under way for the construction of a machine and repair shop and power house to cost about $130,000.

PHILADELPHIA, PA.—Bids will be received by Major H. J. Lumsden, Frankford Arsenal, until Nov. 9 for the installation of an electric lighting system in the new power plant building.

PITTSBURGH, PA. — The Pittsburgh Street Railways Company, Chamber of Commerce Building, has had plans prepared for an addition to its electric power plant on Brunots Island.

WILLIAMSPORT, PA. — The Lycoming Foundry & Machine Company, Oliver Street, has plans under way for the construction of a power house to cost about $30,000.

BALTIMORE, MD. — The Baltimore & Ohio Railroad, B. & O. Terminal, has plans under way for the electrification of certain sections of its line. Plans also include the construction of two hydro-electric plants, one on the Savage River and the other on the Cheat River. J. E. Davis is electrical engineer for the company.

AVONDALE, W. VA. — The Mountain State Coal Company of Huntington is having plans prepared for the erection of an electric power plant at Ritter. C. T. Benson is president.

CHARLESTON, W. VA.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 17 for the construction of an electrical distribution system at the armor plant. (Specification 4294.)

WASHINGTON, D. C. — The Potomac Electric Power Company contemplates power plant improvements and extensions to cost about $600,000.

WASHINGTON, D. C.—The city officials contemplate the installation of a new street-lighting system. Warren B. Hadley is electrical engineer of the district.

North Central States

LAKE CITY, MICH.—Arrangements have been made by a committee of Lake City citizens, headed by Attorney Henry Miltner, to secure electric light and power for the village from the Winterfield Light & Power Company, now erecting a plant on the Clam River.

CLEVELAND, OHIO.—A proposition to issue $90,000 in bonds will be submitted to the voters at the general election for the purpose of erecting an electric light plant in East Cleveland. A. Carran, City Hall, East Cleveland, is in charge.

LOUISVILLE, KY.—The Board of Park Commissioners contemplate the installation of electricity in Central Park at a cost of about $12,500.

INDIANA HARBOR, IND.—The Board of Commissioners of Lake County have filed petition with the State Tax Board for permission to issue $30,000 in bonds for the installation of a police alarm system.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company, Washington and Meridian Streets, contemplates the erection of a 49-ft. x 55-ft. addition to its power plant. Charles Brossman, 1503 Merchants' Bank Building, is engineer.

DELAVAN, ILL.—A special election will be held on Nov. 3 for the purpose of submitting to the voters a proposition to issue $8,000 in bonds for the installation of electrical equipment for the water-works systems, etc.

SPRINGFIELD, ILL.—Ordinances have been passed by the City Council for the installation of a new ornamental lighting system in the area bounded by Williams Boulevard, West Grand Avenue, Park and Lawrence Avenues. The cost is estimated at $7,600.

OSHKOSH, WIS.—Plans will be prepared for the installation of an ornamental street-lighting system at this place. Ira Parker is chairman.

PRINCETON, WIS. — The Princeton Power & Light Company has plans under way for the construction of a hydro-electric plant. The Jacobson Engineering Company, 522 Metropolitan Bank Building, Minneapolis, Minn., is engineer.

SEYMOUR, WIS.—The Badger Utility Company of Pulaski has contracted with the Wisconsin Traction Light, Heat & Power Company for electric power of 400 hp. Plans include the installation of a substation at Seymour.

TWO RIVERS, WIS.—It is reported that the Wisconsin Basket & Pail Company contemplates rebuilding its factory and power plant recently destroyed by fire, causing a loss of about $135,000. New power-plant equipment will be purchased. John F. Conant is president.

UNION GROVE, WIS.—The State Board of Control, M. J. Tappins, secretary, Madison, is having plans prepared for a power plant at the Southern Wisconsin Home for the Feeble Minded. John C. White of Madison is engineer.

BEAVER CREEK, MINN. — A special election will be held for the purpose of submitting to the voters a proposition to issue $13,000 in bonds for an electric lighting system. B. R. Page is city clerk.

MARSHALLTOWN, IOWA. — The City Council has authorized John I. Bell, councilman, to receive bids on poles, wires and other necessary equipment for the construction of a lighting system in the city.

PERU, NEB.—At a recent village meeting an ordinance was passed, calling for a special election to be held soon to vote on $10,000 in bonds for the purchase and improvement of the electric light plant. Extension and improvement to the system are also contemplated.

OTTAWA, KAN.—At a recent election bonds to the amount of $165,000 were voted for improvements to the present municipal light and water plant.

PLEASANTON, KAN.—Preliminary plans have been prepared for the erection of an electric light plant at this place. E. T. Archer & Company, 609 New England Building, Kansas City, Mo., are engineers.

Southern States

MANCHESTER, GA.—Improvements and extensions to the municipal electric light system to cost about $10,000 are contemplated.

SMYRNA, TENN. — A corporation has been formed by the citizens of Smyrna for the purpose of erecting an electric light plant. The stock has been sold and charter secured.

Pacific and Mountain States

WILSONVILLE, ORE. — N. W. Young has had plans prepared for the extension of his electric light system from Wilsonville to the Frog Pond district.

BAKERSFIELD, CAL.—The Pacific Gas & Electric Company has applied to the Railroad Commission for authority to purchase the excess energy of the San Joaquin Light & Power Corporation. Plans will include the erection of a transmission line from the Kerckhoff plant to the San Joaquin's substation at Merced.

GLENDALE, CAL.—The Verdugo Woodlands Improvement Association, recently organized, contemplates improvements to the street-lighting system, telephone service, etc.

GRASS VALLEY, CAL.—The Delhi Mining Company has plans under way for the construction of a hydro-electric plant on Bloody Run. Plans include the installation of two large electric generators and auxiliary operating machinery. Harry Skewes is superintendent.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has applied for permission to appropriate 10 second-ft. from the Pauma Creek, San Diego County, for the development of 560 hp. Diversion works consist of a main ditch and dam. The cost is estimated at about $225,000.

SAN FRANCISCO, CAL. — Application has made to the Railroad Commission by the Coast Valleys Gas & Electric Company to issue $375,000 in bonds, part of the proceeds to be used as follows: Increase capacity of 4,000-volt feeders in Salinas Valley, $20,000; extensions to electric distributions lines during the next twelve months, $12,000; new outdoor high-tension substation at Salinas, $15,000; new distribution substations at east and west sides of the Salinas Valley, $30,000; duplicate transmission line from Metz to King City, $25,000; convert Soldad-King City line from 30 kv. to 60 kv., $30,600; etc.

SAN FRANCISCO, CAL.—According to M. M. O'Shaughnessy, city engineer, plans for the electric power plant at Hetch-Hetchy to cost about $6,000,000 are under way, and the construction of this plant may be followed by the establishment of auxiliary plants at other points. The main plant is to be erected at Priest's Hill where it is expected to develop 76,000 hp.

Record of Electrical Patents

Notes on United States Patents

(Issued Oct. 19, 1920)

14,959 (reissue). WIRELESS TELEPHONE SYSTEM; Lee de Forest, New York, N. Y. App. filed May 16, 1916. Sounds made clear.

1,355,838. INSTANTANEOUS HEATER; Charles D. McLean, Berlin, N. H. App. filed Sept. 22, 1919. For water.

1,355,849. PORTABLE LAMP; Francis M. Rosenfeld, New York, N. Y. App. filed Feb. 5, 1919. Flashlight.

1,355,863. TELEGRAPH INSTALLATION; Oskar Srnka, Brunn, Austria. App. filed June 14, 1915. Any number of messages transmitted simultaneously.

1,355,867. LIQUID HEATER; William I. Thompson, Stoneham, Mass. App. filed Sept. 29, 1919. Radiator.

1,355,869. STATE OF ELECTRICAL REGULATION; William A. Turbayne, Niagara Falls, N. Y. App. filed Feb. 11, 1915. Battery charging from variable-speed generator.

1,355,884. ALTERNATING-CURRENT FREQUENCY METER; John G. Blessing, Chicago, Ill. App. filed Feb. 19, 1917. Meter and timing device.

1,355,886. CUT-OUT BOX; Hector H. Brown, Baltimore, Md. App. filed May 31, 1919. Conduit openings changeable in size.

1,355,887. PANEL BOX; Hector H. Brown, Baltimore, Md. App. filed May 31, 1919. Improved front.

1,355,897. TESTING CIRCUIT FOR REPEATERS EQUIPPED WITH AUTOMATIC NETWORK-SELECTORS; Charles S. Demarest, Brooklyn, N. Y. App. filed Dec. 5, 1918. For amplifying signals.

1,355,898. TESTING AND MONITORING EQUIPMENT FOR REPEATER CIRCUITS; Charles S. Demarest, Brooklyn, N. Y. App. filed Dec. 5, 1918. Artificial loads.

1,355,899. DRY BATTERY; Carleton Ellis and Alfred A. Wells, Montclair, N. J. App. filed Oct. 31, 1917. Made of old materials.

1,355,905. MEANS FOR SECURING ELECTRICAL FITTINGS TO CONDUIT OUTLET BOXES AND THE LIKE; Leonard Milne, Westminster, London, England. App. filed Sept. 30, 1918.

1,355,917. AUTOMATIC TELEPHONE SYSTEM; George E. Schomaker, Chicago, Ill. App. filed May 23, 1917. Two-wire.

1,355,926. TELEPHONE-EXCHANGE SYSTEM; Dawson M. Taggart, East Orange, N. J. App. filed Oct. 23, 1918. Trunk circuits.

1,355,927. TELEPHONE-EXCHANGE SYSTEM; Dawson M. Taggart, East Orange, N. J. App. filed Dec. 28, 1918. Connection of manual with automatic.

1,355,932. COMBINED SOUND AND HEATING ELEMENT; Allen J. Walter, Mansfield, Ohio. App. filed July 5, 1919. Medical.

1,355,943. AUTOMATIC SWITCH FOR CIGAR LIGHTERS, ETC.; Charles F. Cuno, Meriden, Conn. App. filed April 22, 1920. Spring reel.

1,355,957. TELEPHONE TRANSMISSION SYSTEM; Percy M. Gardanier, Bayside, N. Y. App. filed July 23, 1918. Four-wire telephone repeater.

1,355,971. SUBSTATION SENDER; George H. Heydt, New York, N. Y. App. filed Dec. 1, 1916. Mounted in base of desk stand.

1,355,983. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Jacob W. Lattig, Glenside, Pa. App. filed Sept. 11, 1909. "Up-and-around" switch.

1,356,010. AUTOMATIC TELEPHONE SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed April 14, 1917. For large organization.

1,356,012. ELECTRICAL CONTROLLING SYSTEM; Frank B. Rae, Cleveland, Ohio. App. filed March 19, 1917. For charging battery.

1,356,042. TOASTER; Lloyd G. Copeman, Flint, Mich. App. filed Oct. 31, 1919. Removable grid.

1,356,071. ELECTRICALLY HEATED INSTRUMENT; Frank Kuhn and Lawrence H. Thomas, Detroit, Mich. App. filed June 11, 1920. Terminal block housing.

1,356,099. REGULATOR FOR ELECTRIC GENERATORS; William A. Turbayne, Niagara Falls, N. Y. App. filed April 17, 1914. For variable-speed battery-charging generators.

1,356,156. TELEPHONIC RECEIVER; Nathan A. Kurman, New York, N. Y. App. filed Oct. 10, 1917. Diaphragm mounted between cushions.

1,356,164. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed July 14, 1917. Semi-automatic.

1,356,176. LISTENING KEY; Franklin A. Stearn, Paterson, N. J. App. filed Oct. 25, 1916. Telephone.

1,356,181. TELEPHONE-EXCHANGE SYSTEM; Ray S. Wilbur, Lyndhurst, N. J. App. filed May 21, 1919. Automatic ringing.

1,356,190. TELEPHONIC TRANSMITTER; Bertram S. Cohen, Twickenham, England. App. filed Dec. 31, 1919. Placed against throat.

1,356,197. PROCESS OF PRODUCING A DOUBLE-COPPER-OXIDE PLATE; George S. Engle, Oranston, R. I. App. filed Oct. 8, 1912. For primary batteries.

1,356,222. MULTIPLE TELEPHONY; Ernst Ruhmer, Berlin, Germany. App. filed April 4, 1911. Several messages by one wire.

1,356,226. SYNCHRONIZER; Melvin L. Severy, Los Angeles, Cal. App. filed May 7, 1917. For synchronizing two independently driven and distant shafts.

1,356,244. ALTERNATING-CURRENT GENERATOR; Thomas F. Wall, Southsea, England. App. filed Sept. 30, 1918. For reciprocating drills, hammers, etc.

1,356,256. TELEPHONE SYSTEM; William G. Britten, Westfield, N. J. App. filed Aug. 19, 1918. Announcing system.

1,356,260. APPARATUS FOR DISPLAYING UNITS AND QUOTATIONS, NEWS AND ADVERTSING; William H. Butler, New York, N. Y. App. filed 28, 1919. For increasing utility of stock ticker.

1,356,290. MOTOR; Orlando E. Kellum, Los Angeles, Cal. App. filed March 10, 1920. Synchronous, for phonographs, etc.

1,356,293. DIMMER FOR ELECTRIC LIGHTS; Eugene J. Klinger, South Elgin, Ill. App. filed Dec. 13, 1919. Automobile.

1,356,335. ELECTRIC HEATER; Pierre J. H. Bernard, Montreal, Quebec, Canada. App. filed May 29, 1919. High-resistance ribbon wound on mica cylinder.

1,356,342. MANUFACTURE OF NICKEL-STEEL; Percy F. Cowing, New York, N. Y. App. filed June 16, 1920. As a cathode deposit.

1,356,369. TROLLEY POLE; Axel A. Johnson, Hoquian, Wash. App. filed May 24, 1920. Replaces wire on wheel.

1,356,403. TELEPHONE SYSTEM; Edwin S. Pridham, Oakland, Cal. App. filed May 7, 1918. For noisy places.

1,356,434. PROCESS OF MAKING ALKALINE GELATINOUS ELECTROLYTES; George S. Engle, Cranston, R. I. Oct. 8, 1912. Prevents dissemination of soluble electrodes.

1,356,435. DOUBLE-COPPER-OXIDE Battery Element; George S. Engle, Washington, D. C. App. filed Oct. 8, 1912. For primary batteries.

1,356,436. ELECTROLYTE FOR PRIMARY BATTERIES; George S. Engle, Washington, D. C. App. filed Oct. 8, 1912. Alkaline, gelatinous and has minimum causticity.

1,356,468. ELECTRODE; George W. Peters and Oscar F. Alkire, Charleston, Wash. App. filed Feb. 27, 1920. Made from rolled strip.

1,356,484. ELECTRIC APPARATUS; Anthony T. Boltas, Plainfield, N. J. App. filed Aug. 19, 1919. For stimulating rain.

1,356,488. RADIO-TELEGRAPH SYSTEM; Marico Compare, Leghorn, Italy. App. filed July 6, 1920. Control from a distance.

1,356,505. SYSTEM OF GUNFIRE CONTROL; Elmer A. Sperry, Brooklyn, N. Y. App. filed Oct. 10, 1914. To indicate to control station the position of guns.